Valley Water

Annual Groundwater Report
for Calendar Year 2020

SANTA CLARA VALLEY WATER DISTRICT

ANNUAL GROUNDWATER REPORT FOR CALENDAR YEAR 2020

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Executive Summary

EXECUTIVE SUMMARY

The Santa Clara Valley Water District (Valley Water) is the Groundwater Sustainability Agency (GSA) for the Santa Clara and Llagas Subbasins[1] in Santa Clara County, which are sustainably managed through the comprehensive activities described in Valley Water's 2016 Groundwater Management Plan (GWMP).[2] This Annual Groundwater Report for Calendar Year (CY) 2020 is separate from and more comprehensive than the annual Water Year (WY) report required under the Sustainable Groundwater Management Act (SGMA). This report describes groundwater use, levels, quality, storage, and land subsidence and presents the status of GWMP outcome measures using recent data. These measures identified in the GWMP are used to evaluate performance relative to Valley Water Board of Directors (Board) Water Supply Objectives 2.2.1 and 2.2.2[3]: "*Manage groundwater to ensure sustainable supplies and avoid land subsidence" and "Aggressively protect groundwater from the threat of contamination*."

Groundwater pumping by water retailers and other well users was 135,800 acre-feet (AF)[4], providing 44% of the total water used in the county in 2020. To help sustain and protect groundwater supplies, in 2020 Valley Water:

- Recharged groundwater with 81,100 AF of local and imported surface water,
- Reduced groundwater demands by 195,000 AF through treated surface water deliveries as well as recycled water and water conservation programs, which collectively provide in-lieu groundwater recharge,
- Conducted extensive monitoring and analysis of groundwater levels and quality, and land subsidence,
- Implemented the well ordinance program and other activities to minimize threats to groundwater quality, and
- Worked with basin stakeholders, land use agencies, and regulatory agencies to protect groundwater.

Table ES-1 shows data for key indicators in 2020 as compared to 2019 and prior periods. Having previously fully recovered from the 2012-2016 drought, groundwater levels and storage continued to rise and reach near historic highs in 2018 and 2019. Due to the below average precipitation in 2020,

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[1] California Department of Water Resources (DWR) Basins 2-9.02 and 3-3.01, respectively. Valley Water identifies two groundwater management areas (Santa Clara Plain and Coyote Valley) within the Santa Clara Subbasin.
[2] This plan was submitted to DWR as an Alternative to a Groundwater Sustainability Plan in December 2016 and approved for SGMA compliance in July 2019. The first required five-year update was adopted by the Board of Directors in November 2021 and submitted to DWR before the statutory deadline of January 1, 2022. The 2021 Annual Groundwater Report will reference the 2021 Groundwater Management Plan.
[3] Valley Water Ends Policy E-2, including Water Supply Objectives 2.21 and 2.2.2, was revised by the Board on June 22, 2021.
[4] All values presented in this report are based on best available data (measured or estimated) and may be refined as additional data becomes available.

groundwater levels and storage fell compared to 2019, with an estimated 21,700 AF[5] decrease in groundwater storage in 2020 because pumping and other outflows exceeded recharge. Average groundwater levels in 2020 were lower than in 2019 and the five-year average in regional index wells and at many other wells around the county. However, estimated end of 2020 total groundwater storage was 337,100 AF, which falls within the normal stage (Stage 1) of Valley Water's Water Shortage Contingency Plan, indicating good groundwater supply despite the dry hydrologic conditions.

Table ES-2 shows groundwater quality conditions compared to other years and median concentrations for Total Dissolved Solids (TDS) and nitrate. Groundwater quality remained generally good in principal aquifer zones; countywide, median values for TDS were at or below 420 milligrams per liter (mg/L) and median nitrate values were at or below 5.3 mg/L (Appendix C), which is below the drinking water standard of 10 mg/L. However, because elevated nitrate persists in individual wells, Valley Water continues to work with regulatory and land use agencies to address this ongoing groundwater protection challenge.

North County Groundwater Summary

Groundwater use in the Santa Clara Plain (the northern Santa Clara Subbasin) was 81,800 AF in 2020, a 42% increase from 2019. This is below the long-term average of 95,000 AF due to continued lower demand and increased use of treated surface water by water retailers. Pumping locations and uses remained relatively stable, with nearly all (99%) groundwater used for municipal and industrial (M&I) purposes.

Due to the below average precipitation in 2020, average groundwater levels were lower compared to 2019. However, 2020 groundwater levels remained well above the minimum thresholds established to protect against land subsidence. Land subsidence data for 2020 indicates compaction, reflecting the below average precipitation that led to pumping and other outflows exceeding recharge. The compaction in 2020 likely represents elastic (non-permanent) subsidence in response to the dry hydrologic conditions. Estimated groundwater storage at the end of 2020 was 300,000 AF, which was 16,000 AF lower than 2019 but above the 278,000 AF GWMP outcome measure.

North County groundwater continues to have very good quality overall. In 2020, 100% of water supply wells tested met all health-based drinking water standards. Public water systems must comply with drinking water standards, which may require treatment or blending prior to delivery.

South County Groundwater Summary

In 2020, groundwater pumping in the Coyote Valley (the southern Santa Clara Subbasin) and Llagas Subbasin was 11,400 AF and 42,600 AF, respectively. Pumping increased by 7% in the Coyote Valley and by 6% in the Llagas Subbasin compared to 2019. Most pumping in the Coyote Valley was for M&I uses (72%), with smaller amounts for agricultural (26%) and domestic (2%) uses. In the Llagas Subbasin, 54% of total pumping was for agriculture, 42% for M&I use, and 4% for private domestic use.

[5] Groundwater storage estimates presented in this report are as of June 2021 and represent accumulated storage as described further in Chapter 3.

Estimated groundwater storage in South County (Coyote Valley and Llagas Subbasin) at the end of 2020 was 37,100 AF, which is 5,700 AF lower than 2019. Similar to North County, average groundwater levels in 2020 were lower compared to 2019 and the five-year average, reflecting the below average precipitation and dry hydrologic conditions.

Groundwater quality in South County is generally good, with most water supply wells meeting drinking water standards. However, nitrate continues to be a significant groundwater quality challenge; it was detected above the drinking water standard in 13% of South County water supply wells tested in 2020. As described in the outcome measure summary below, Valley Water continues to work to address this challenge.

Table ES-1. CY 2020 Groundwater Supply Conditions Compared to Other Years

Index – Groundwater Supply	2020	Compared to 2019	Compared to 5-Year Average (2016–2020)
Total Managed Recharge (AF)	81,100	Down 3%	Down 20%
Total Groundwater Pumping (AF)	135,800	Up 25%	Up 14%
Groundwater as % of Total Water Use	44%	Up 7%	Down 2%
Groundwater Elevations (feet, NGVD88)[1]			
Santa Clara Plain	74.5	Down 16.2 feet	Down 11.7 feet
Coyote Valley	271.4	Down 5.8 feet	Down 3.8 feet
Llagas Subbasin	245.5	Down 12 feet	Down 4.9 feet
End of Year Groundwater Storage (AF)	337,100	Down 6%	Up 1%
Land Subsidence (feet/year)[2]	0.037 (Aquifer compaction)	Aquifer compaction	Aquifer compaction

Notes:

1. Groundwater elevations are shown for three groundwater management areas: the Santa Clara Plain and Coyote Valley (which comprise the Santa Clara Subbasin) and the Llagas Subbasin. Groundwater elevations represent the average of all readings at three regional groundwater level index wells for the time period noted based on the National Geodetic Vertical Datum of 1988.
2. Valley Water calculates subsidence using the average measured subsidence at two extensometers over the most recent 11-year period (Appendix A). Measured compaction is less than the established tolerable rate of 0.01 feet/year, and throughout 2020, water levels at all ten subsidence index wells were greater than minimum thresholds established to prevent permanent subsidence.

Table ES-2. CY 2020 Groundwater Quality Conditions Compared to Other Years

Index – Groundwater Quality[1]	2020 Median[2]	5-Year Step Trend[3]	10-Year Step Trend	15-Year Step Trend
Total Dissolved Solids in Principal Aquifers (TDS, mg/L)				
Santa Clara Plain	420	No Change	No Change	No Change
Coyote Valley	334	No Change	No Change	No Change
Llagas Subbasin	375	No Change	No Change	No Change
Nitrate in Principal Aquifers (as Nitrogen, mg/L)				
Santa Clara Plain	2.9	No Change	Decrease (0.5 mg/L)	No Change
Coyote Valley	1.3	No Change	No Change	No Change
Llagas Subbasin	5.3	No Change	No Change	No Change

Notes:

1. Groundwater quality indices are shown for three groundwater management areas: the Santa Clara Plain and Coyote Valley (which comprise the Santa Clara Subbasin) and the Llagas Subbasin.
2. Values represent the median groundwater concentration for principal aquifer zone wells tested (both water supply wells and monitoring wells).
3. The median 2020 concentration for each groundwater management area was compared to that of 5 years ago (2016), 10 years ago (2010), and 15 years ago (2005) to determine if there is any statistically significant difference using the Mann-Whitney test at the 95% confidence level.

Outcome Measure Summary

The GWMP identifies outcome measures to assess performance relative to Board policy and groundwater sustainability goals. The status of these measures using 2020 data is shown in Table ES-3 below, along with actions to address measures not being met. All outcome measures related to groundwater storage, levels, and land subsidence were met in 2020. Despite dry hydrologic conditions in 2020, the continued sustainable groundwater supply conditions demonstrate the effectiveness of significant investments in basin management facilities, diverse water supplies, and conjunctive water management, as well as close coordination with water retailers.

Elevated nitrate continues to be the primary groundwater protection challenge in South County, where a significant number of domestic wells contain water with nitrate above the drinking water standard. Valley Water continues to coordinate with land use and regulatory agencies to influence related policies, regulations, and decisions. More directly, Valley Water's managed recharge programs help dilute nitrate, and water quality testing helps to reduce well owner exposure. While most wells have stable or decreasing long-term chloride concentrations, increasing concentrations in some shallow aquifer wells warrant continued tracking and evaluation.

Table ES-3. Summary of 2020 Outcome Measure Performance and Action Plan

Groundwater Storage	**OM 2.1.1.a.** Greater than 278,000 AF of projected end of year groundwater storage in the Santa Clara Plain. **Outcome measure met**: End of 2020 groundwater storage is 300,000 AF.
	OM 2.1.1.b. Greater than 5,000 AF of projected end of year groundwater storage in the Coyote Valley. **Outcome measure met**: End of 2020 groundwater storage is 13,400 AF.
	OM 2.1.1.c. Greater than 17,000 AF of projected end of year groundwater storage in the Llagas Subbasin. **Outcome measure met**: End of 2020 groundwater storage is 23,700 AF.
Groundwater Levels and Subsidence	**OM 2.1.1.d.** 100% of subsidence index wells with groundwater levels above subsidence thresholds. **Outcome measure met**: All ten wells had groundwater levels above thresholds in 2020.
Groundwater Quality	**OM 2.1.1.e.** At least 95% of countywide water supply wells meet primary drinking water standards. **Outcome measure met**: 96% of water supply wells tested in 2020 had water that met primary drinking water standards. If nitrate is not included, 100% of water supply wells met primary drinking water standards. **OM 2.1.1.f.** At least 90% of Coyote Valley and Llagas Subbasin wells meet Basin Plan agricultural objectives. **Outcome measure met**: All wells (100%) had water that met agricultural objectives.
Groundwater Quality Trends	**OM 2.1.1.g.** At least 90% of wells have stable or decreasing concentrations of nitrate, chloride, and total dissolved solids. **Outcome measure partially met**: This measure is not met for chloride, with 81% of wells having water with stable or decreasing concentration trends. The measure is met for nitrate and total dissolved solids, with stable or decreasing concentrations observed in 93% and 91% of wells, respectively.
	Action Plan for OM 2.1.1.g. Implement Salt and Nutrient Management Plans to address salt loading, continue collaborating with regulatory and land use agencies.

Status of Sustainable Groundwater Management Act (SGMA) Compliance

In July 2019, DWR approved Valley Water's GWMP for the Santa Clara and Llagas Subbasins, finding it satisfied the objectives of SGMA. On November 23, 2021, the Valley Water Board of Directors adopted the 2021 Groundwater Management Plan as the first required five-year update to the approved Alterative. Valley Water submitted the 2021 Groundwater Management Plan to DWR prior to the January 1, 2022, deadline. The 2021 Annual Groundwater Report will reference the 2021 Groundwater Management Plan. Valley Water has submitted four annual reports for these subbasins as required by SGMA, with the most recent submittal (April 2021) included as an appendix to this report.

As the GSA for the small portions of the North San Benito Subbasin[6] in Santa Clara County, Valley Water has supported San Benito County Water District (SBCWD) efforts to develop a GSP for the entire subbasin. The North San Benito GSP was adopted by the SBCWD Board of Directors on November 17, 2021, and by the Valley Water Board of Directors on December 14, 2021. The North San Benito GSP was submitted to DWR before the statutory deadline of January 31, 2022.

Groundwater Management Plan Implementation

To maintain sustainable groundwater conditions, Valley Water continues to implement the proactive groundwater management activities described in the GWMP. Chapter 6 of this report summarizes the status of the six major GWMP recommendations.

Continued groundwater sustainability is central to the Valley Water mission to provide Silicon Valley safe, clean water for a healthy life, environment, and economy. As such, Valley Water will continue to "manage groundwater to ensure sustainable supplies and avoid land subsidence," and "aggressively protect groundwater from the threat of contamination" in accordance with Board Ends policy.

[6] This subbasin is primarily located in San Benito County, where the San Benito County Water District (SBCWD) is the GSA. In 2019, DWR approved a basin boundary modification creating the North San Benito Subbasin through consolidation of several subbasins. The subbasins consolidated into the North San Benito Subbasin include the former Hollister and San Juan Bautista subbasins, which extend into Santa Clara County.

CHAPTER 1

Introduction

CHAPTER 1 – INTRODUCTION

The Santa Clara Valley Water District (Valley Water) has the responsibility and authority to manage the Santa Clara and Llagas groundwater subbasins in Santa Clara County per the California legislature.[1] Valley Water formally became the Groundwater Sustainability Agency (GSA) for these subbasins in 2016. Valley Water's comprehensive groundwater management activities and investments, described in the 2016 Groundwater Management Plan (GWMP)[2], have resulted in sustainable groundwater conditions for many decades. Valley Water's groundwater management objectives and authority under the Santa Clara Valley Water District Act (District Act) are to recharge groundwater basins, conserve, manage and store water for beneficial and useful purposes, increase water supply, protect surface water and groundwater from contamination, prevent waste or diminution of the water supply, and do any and every lawful act necessary to ensure sufficient water is available for present and future beneficial uses.

Valley Water Board of Directors (Board) Water Supply Objectives 2.2.1 and 2.2.2 reflect the mission to protect groundwater resources: *"Manage groundwater to ensure sustainable supplies and avoid land subsidence" and "Aggressively protect groundwater from the threat of contamination."* Pursuant to the District Act and Board policy, Valley Water identifies the following basin management objectives in the GWMP[3]:

- Groundwater supplies are managed to optimize water supply reliability and minimize land subsidence.
- Groundwater is protected from contamination, including salt water intrusion.

Purpose

This annual report describes groundwater conditions in the Santa Clara and Llagas Subbasins for Calendar Year (CY) 2020 including groundwater use, recharge, water levels, water balance, storage, quality, and land subsidence. The following outcome measures (OM) derived from the GWMP are also assessed to evaluate performance in meeting Water Supply Objectives 2.2.1 and 2.2.2:

- OM 2.2.1.a: Greater than 278,000 AF[4] of projected end of year groundwater storage in the Santa Clara Plain.[5]

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[1] Santa Clara Valley Water District Act, Water Code Appendix, Chapter 60.
[2] Santa Clara Valley Water District, Groundwater Management Plan, November 2016.
[3] Valley Water submitted this plan to the California Department of Water Resources as an Alternative to a Groundwater Sustainability Plan for Sustainable Groundwater Management Act compliance. The plan was approved in July 2019. The first required five-year update of the Groundwater Management Plan was approved by the Board of Directors in November 2021 and submitted to DWR before the statutory deadline of January 1, 2022. The 2021 Annual Groundwater Report will reference the 2021 Groundwater Management Plan.
[4] AF = acre-feet. One acre-foot is equal to 325,851 gallons.
[5] As described subsequently, Valley Water identifies two groundwater management areas (Santa Clara Plain and Coyote Valley) within the Santa Clara Subbasin.

- OM 2.2.1.b: Greater than 5,000 AF of projected end of year groundwater storage in the Coyote Valley.
- OM 2.2.1.c: Greater than 17,000 AF of projected end of year groundwater storage in the Llagas Subbasin.
- OM 2.2.1.d: 100% of Santa Clara Plain subsidence index wells with groundwater levels above subsidence thresholds.
- OM 2.2.1.e: At least 95% of countywide water supply wells meet primary drinking water standards.
- OM 2.2.1.f: At least 90% of Coyote Valley and Llagas Subbasin wells meet Basin Plan agricultural objectives.
- OM 2.2.1.g: At least 90% of wells have stable or decreasing concentrations of nitrate, chloride, and total dissolved solids.

The Santa Clara and Llagas Subbasins, located in Santa Clara County, are identified by the California Department of Water Resources (DWR) as Basin 2-9.02 and Basin 3-3.01, respectively (Figure 1). Valley Water divides the Santa Clara Subbasin into two groundwater management areas, the Santa Clara Plain and the Coyote Valley, due to different land use and management characteristics. The Santa Clara and Llagas Subbasins are separated by a groundwater divide near Cochrane Road in Morgan Hill. Groundwater in the Santa Clara Subbasin generally flows toward San Francisco Bay, while flow in the Llagas Subbasin is generally to the southeast toward the Pajaro River. The Santa Clara Plain and Llagas Subbasin have both confined and recharge areas. Within the confined areas, low permeability clays and silts separate shallow and principal aquifers, with the latter defined as aquifer materials greater than 150 feet below ground surface. The recharge areas are unconfined as there are no laterally extensive aquitards forming distinct shallow and principal aquifer zones.

The information in this report is summarized by groundwater management area or by groundwater benefit zone (Figure 2). Groundwater benefit zones are areas where Valley Water collects fees from groundwater users based on the benefits received from Valley Water groundwater management activities. Zone W-2 generally coincides with the Santa Clara Plain, Zone W-7 with the Coyote Valley, and Zones W-5 and W-8 with the Llagas Subbasin.[6]

[6] In April 2020, the Valley Water Board of Directors approved changes to the groundwater benefit zones that included modifications to the boundary of Zone W-2 and a partitioning of Zone W-5 into three zones effective July 1, 2020. The new approved zones are used in this report.

Report Content

In addition to this Introduction, this Annual Groundwater Report for 2020 includes the following chapters:

- Chapter 2: Groundwater Pumping, Recharge, and Water Balance
- Chapter 3: Groundwater Levels and Storage
- Chapter 4: Land Subsidence
- Chapter 5: Groundwater Quality
- Chapter 6: Other Groundwater Management Activities

Figure 1. Santa Clara and Llagas Subbasins

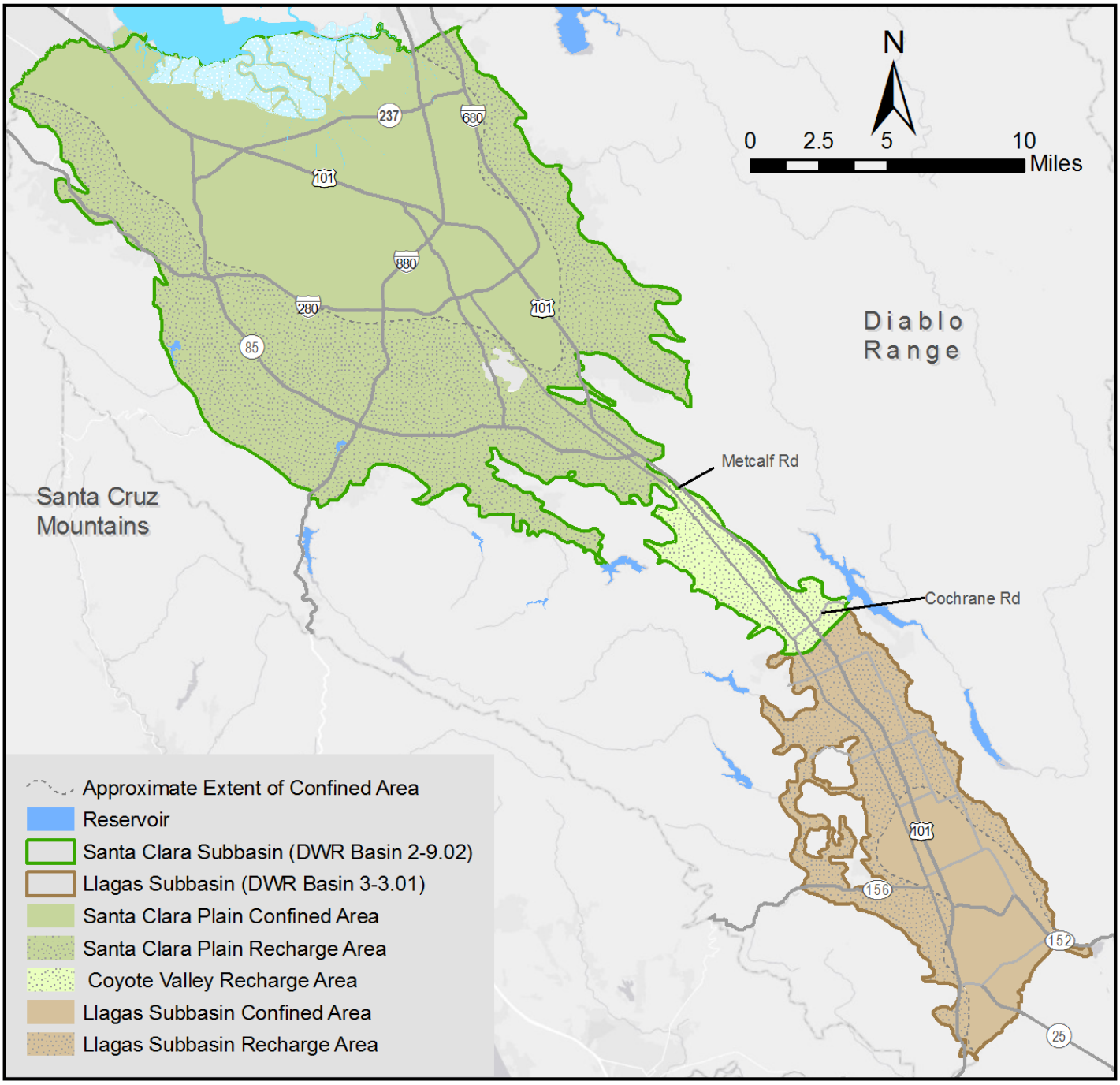
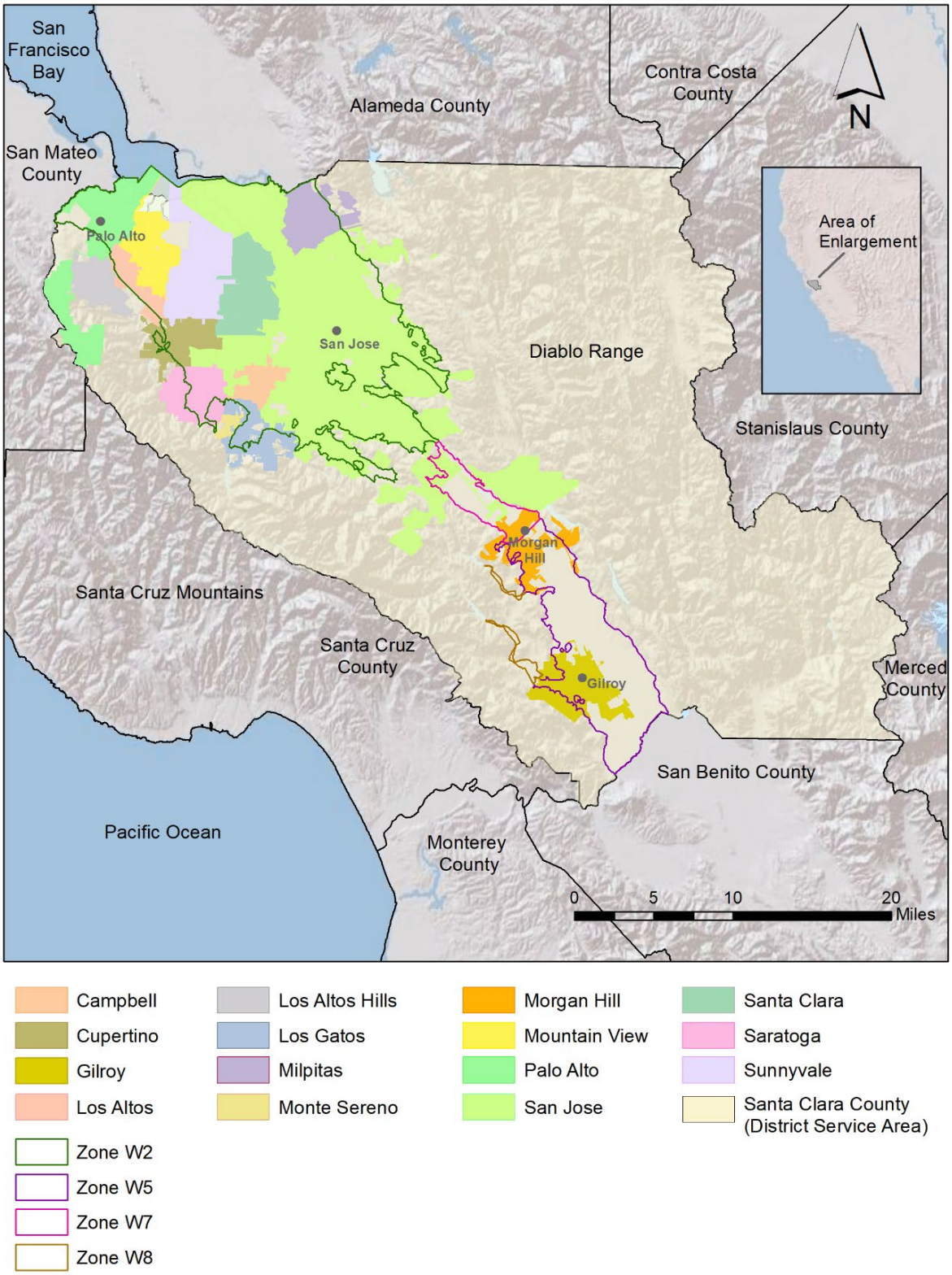


Figure 2. Groundwater Benefit Zones and Local Cities



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CHAPTER 2

Groundwater Pumping, Recharge, and Water Balance

CHAPTER 2 – GROUNDWATER PUMPING, RECHARGE, AND WATER BALANCE

Total groundwater pumping for 2020 in Santa Clara County was 135,800 AF (Table 1), providing 44% of the total water used[1] by county residents and businesses. Compared to 2019, groundwater pumping increased 42% in the Santa Clara Plain, 7% in the Coyote Valley, and 6% in the Llagas Subbasin in 2020. Valley Water used about 81,100 AF of local and imported surface water to replenish the groundwater subbasins through managed recharge. In-lieu recharge, including treated and recycled water deliveries and water conservation programs, reduced demands on groundwater by approximately 195,000 AF.

Managed recharge provided about 63% of the total inflow to the subbasins and groundwater pumping accounted for about 91% of outflows. In 2020, the outflows exceeded the inflows, resulting in a net decrease in countywide groundwater storage of 21,700 AF from 2019 to 2020.

2.1 Groundwater Pumping

Approximately 135,800 AF of groundwater was pumped in 2020, compared to 108,300 AF in 2019. Figures 3 and 4 show the locations and volumes of groundwater pumping in the Santa Clara and Llagas subbasins, respectively, and Table 1 summarizes the pumping by groundwater management area and use category.

Groundwater in North County is used primarily for Municipal and Industrial (M&I) purposes, with minimal agricultural or domestic use (Table 1). In South County, agricultural use is more significant. This is especially evident in the Llagas Subbasin, where 54% of the use is for agriculture. While the quantity of groundwater used for domestic purposes is relatively small in South County, 74% of the 3,909 individual wells reporting groundwater use in South County were domestic wells (Table 2).

[1] Total water use in the county was 311,000 AF (estimated June 2021), which includes groundwater pumping (44%), Valley Water treated water deliveries (33%), San Francisco Public Utilities Commission supplies to local retailers (16%), recycled water deliveries (5%), raw surface water deliveries (1%), and San Jose Water Company and Stanford water rights (1%). This total does not reflect groundwater pumping in bedrock areas outside groundwater benefit zones; these areas are sparsely populated compared to the valley floor, with presumed low water use.

Table 1. CY 2020 Groundwater Pumping by Use (AF)

Use	North County	South County		Total
	Santa Clara Plain	Coyote Valley	Llagas Subbasin	
Municipal & Industrial (M&I)	80,700	8,200	17,900	106,800
Domestic	200	200	1,800	2,200
Agricultural	900	3,000	22,900	26,800
TOTAL	**81,800**	**11,400**	**42,600**	**135,800**

Note: Large volume pumpers are metered and report groundwater production to Valley Water monthly. Pumping for wells reporting semi-annually or annually (primarily domestic and agricultural) was estimated based on available data and/or prior year data as validated data was not available by the date of publication of this report.

Table 2. Number of Wells Reporting Groundwater Use in CY 2020

Use	North County	South County		Total
	Santa Clara Plain	Coyote Valley	Llagas Subbasin	
Municipal & Industrial (M&I)	681	67	288	1,036
Domestic	310	352	2,541	3,203
Agricultural	42	93	568	703
TOTAL	**1,033**	**512**	**3,397**	**4,942**

Note: Some wells may report pumping for more than one use category (e.g., domestic and agricultural). The number of wells reporting semi-annually or annually (primarily domestic and agricultural) was estimated based on the prior year as validated data was not available by the date of publication of this report.

Figure 3. CY 2020 Santa Clara Subbasin Groundwater Pumping

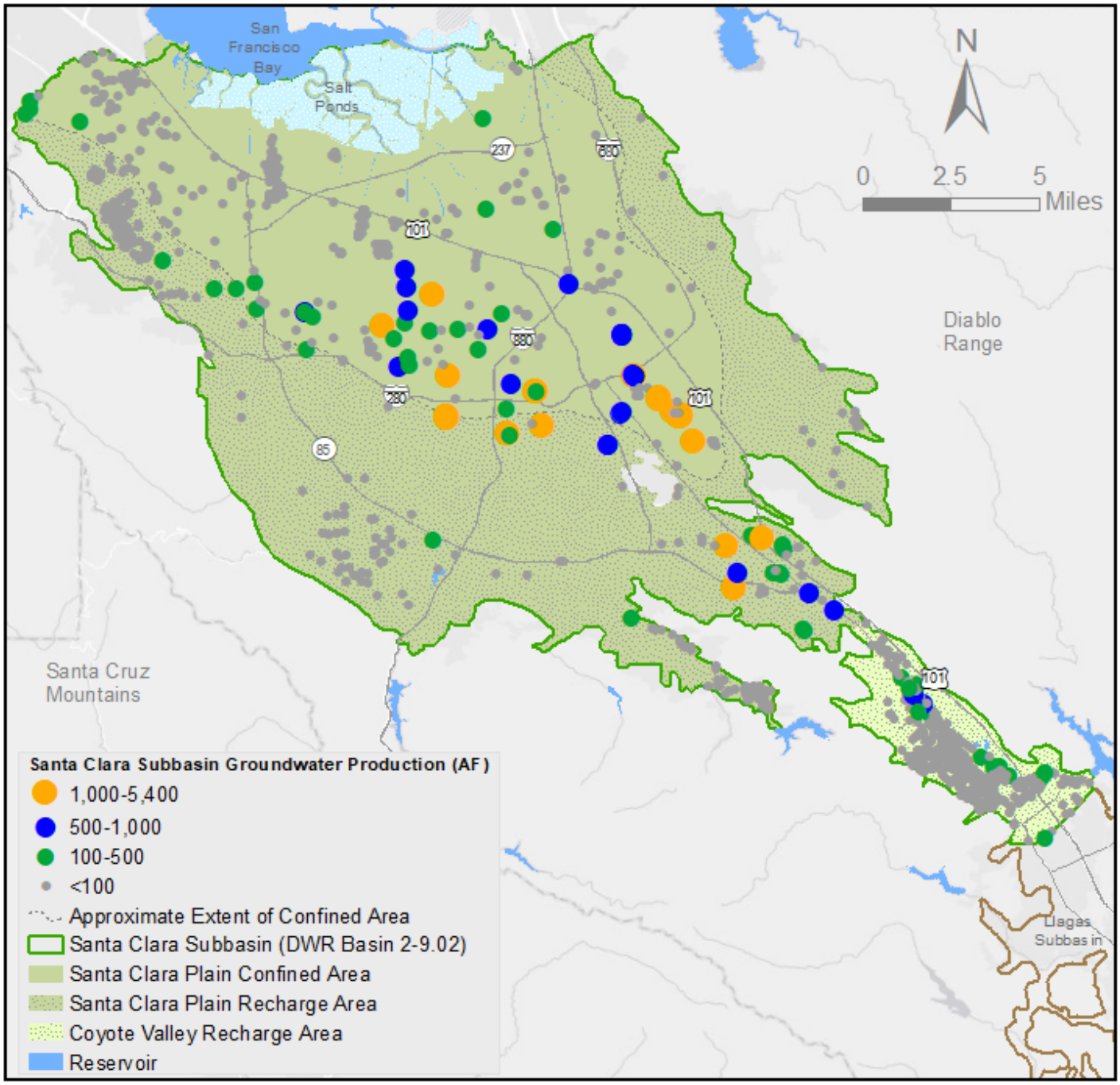
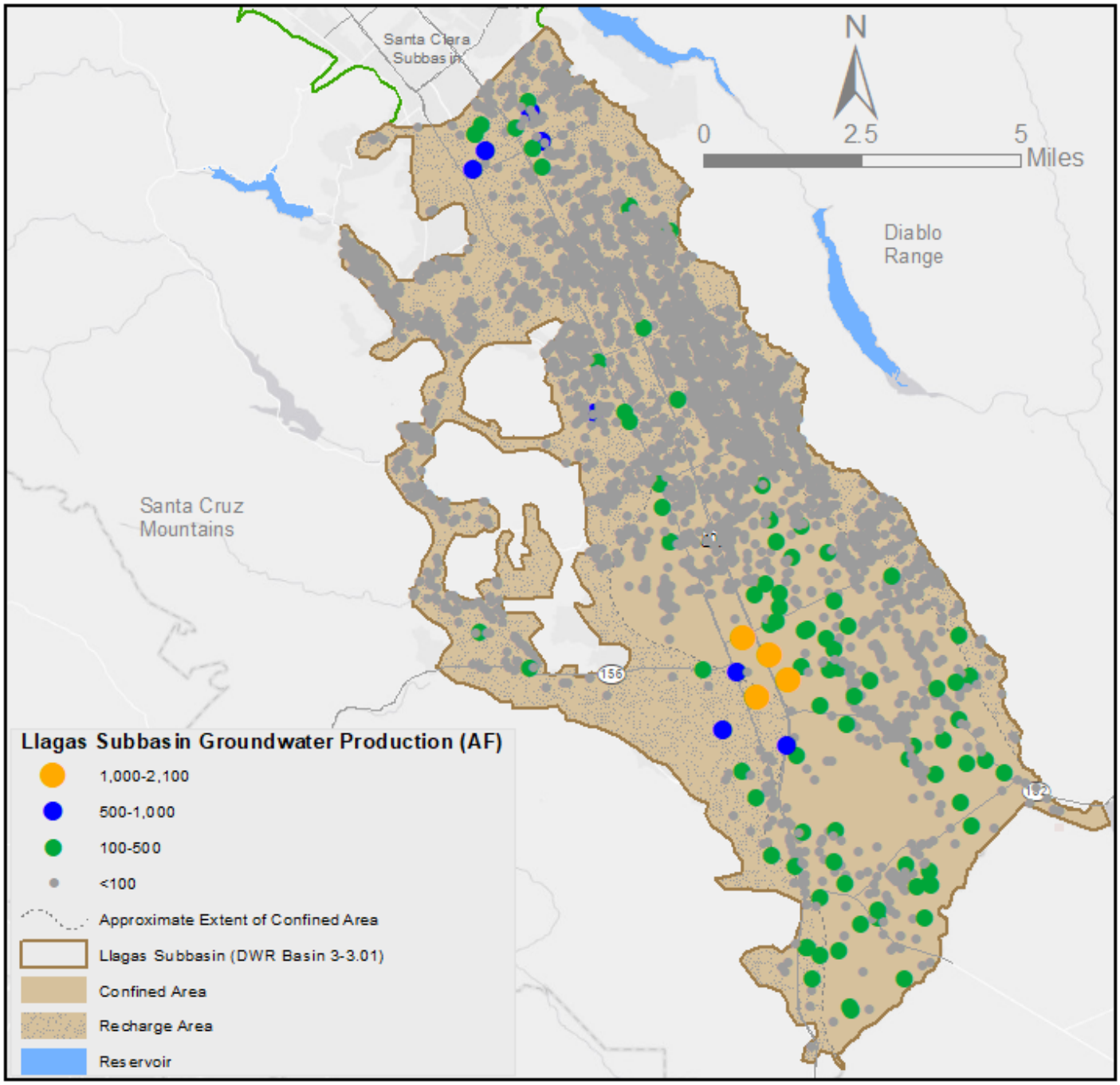


Figure 4. CY 2020 Llagas Subbasin Groundwater Pumping



Groundwater Pumping Trends

Countywide, estimated total water use was 311,000 AF in 2020, slightly more than 2019 (293,000 AF). Countywide groundwater pumping in 2020 was up 25% from the previous year, above the recent five-year average, and below the average over the period of record (Table 3). This is largely driven by relatively high pumping in the Santa Clara Plain during 2020. Compared to last year, groundwater pumping increased 42% in the Santa Clara Plain, 7% in the Coyote Valley, and 6% in the Llagas Subbasin. Groundwater pumping is largely offset by Valley Water's managed recharge of local and imported surface water (Figure 5). Managed recharge typically averages about two thirds of the pumping, with natural recharge balancing the remaining pumping. Figure 6 shows the countywide water use by source, including groundwater, Valley Water treated water, San Francisco Public Utility Commission (SFPUC) supplies, local surface water, and recycled water. Groundwater provided 44% of the total water used countywide in 2020.

Groundwater pumping and use patterns over time are shown in Figure 7 for each of the groundwater management areas. In the Santa Clara Plain, pumping dropped significantly in the late 1980s following completion of Valley Water's Santa Teresa Water Treatment Plant (WTP). Since then, pumping has averaged 95,000 AF per year. Pumping spiked to 115,000 AF in 2014 during the 2012–2016 drought. However, the water retailers and community responded to the Valley Water Board's calls for water use reduction, and pumping decreased significantly during the past five years, averaging about 65,600 AF per year. Pumping increased significantly in 2020 due to dry conditions and limited surface water supplies.

Long-term pumping in the Coyote Valley and Llagas Subbasin has been more stable, except for a notable increase in pumping in the Coyote Valley in 2006 when a water retailer installed new wells and began extracting water to serve customers in the Santa Clara Plain. This increased the average annual pumping volume in Coyote Valley after 2006 by about 4,900 AF (Figure 7). South County pumping also increased from 2019 to 2020, although to a lesser degree than in North County.

Table 3. CY 2020 Groundwater Pumping Compared to Other Periods (AF)

Period	North County	South County		Total
	Santa Clara Plain	Coyote Valley	Llagas Subbasin	
2020	81,800	11,400	42,600	135,800
2019	57,500	10,700	40,100	108,300
5 Year Average (2016-2020)	65,600	11,500	41,600	118,700
Period of Record (Average)	108,600	9,100	42,400	160,100

Note: The period of record is 1981–2020 for the Santa Clara Plain and 1988–2020 for the Coyote Valley and Llagas Subbasin.

Major Groundwater Users

The largest groundwater users in North and South County are shown in Figure 8. Water retailers are the primary users in North County, accounting for over 93% of all pumping in 2020. San Jose Water Company is the largest individual user, accounting for 66% of total North County pumping, followed by other retailers and a few large industrial users. Unlike North County, 51% of pumping in South County was from thousands of individual pumpers including agricultural and domestic users. In South County, pumping by water retailers and water companies accounted for 41% of groundwater use. Other large users include golf courses and industrial facilities.

Figure 5. Countywide Groundwater Pumping and Managed Recharge

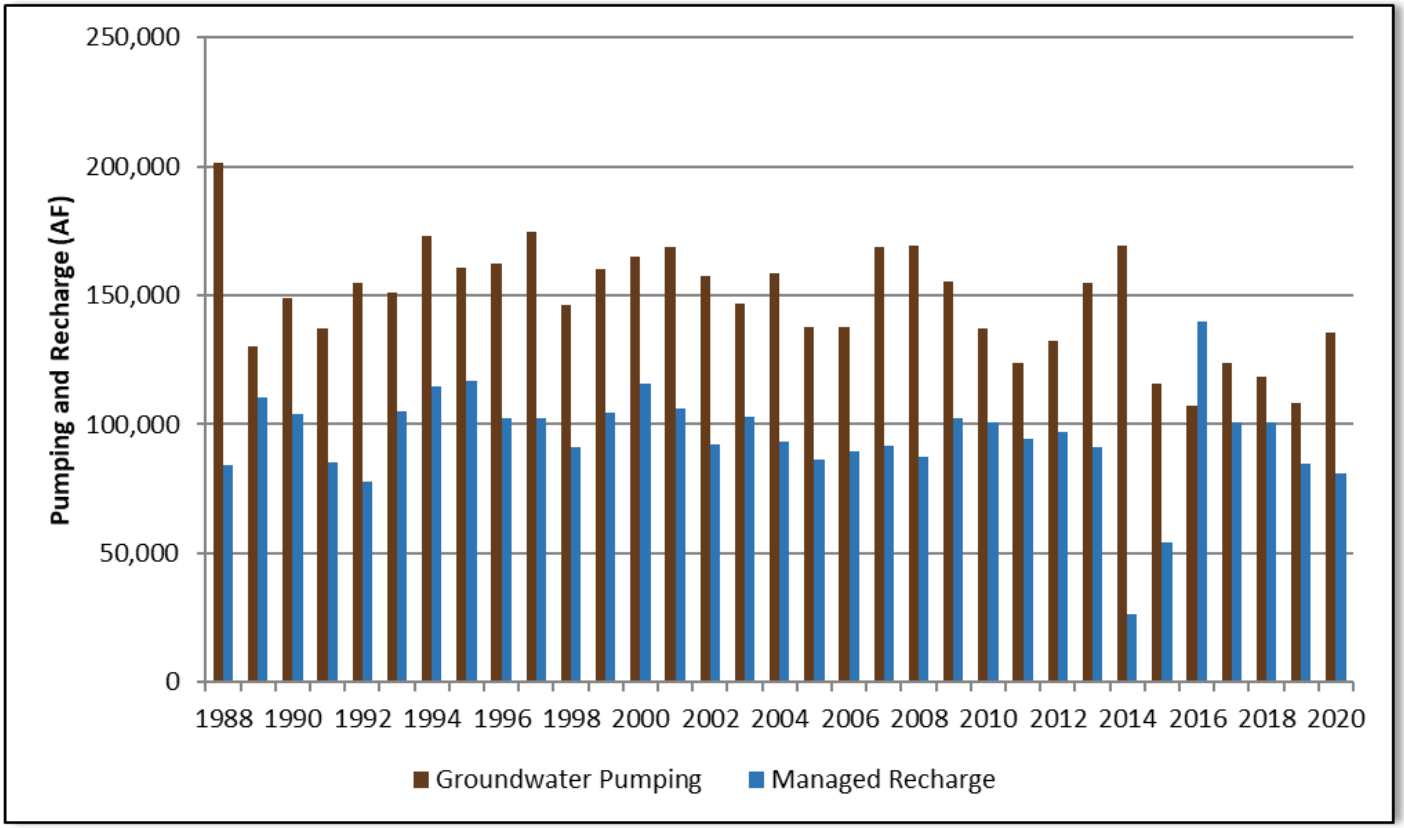


Figure 6. Countywide Water Use

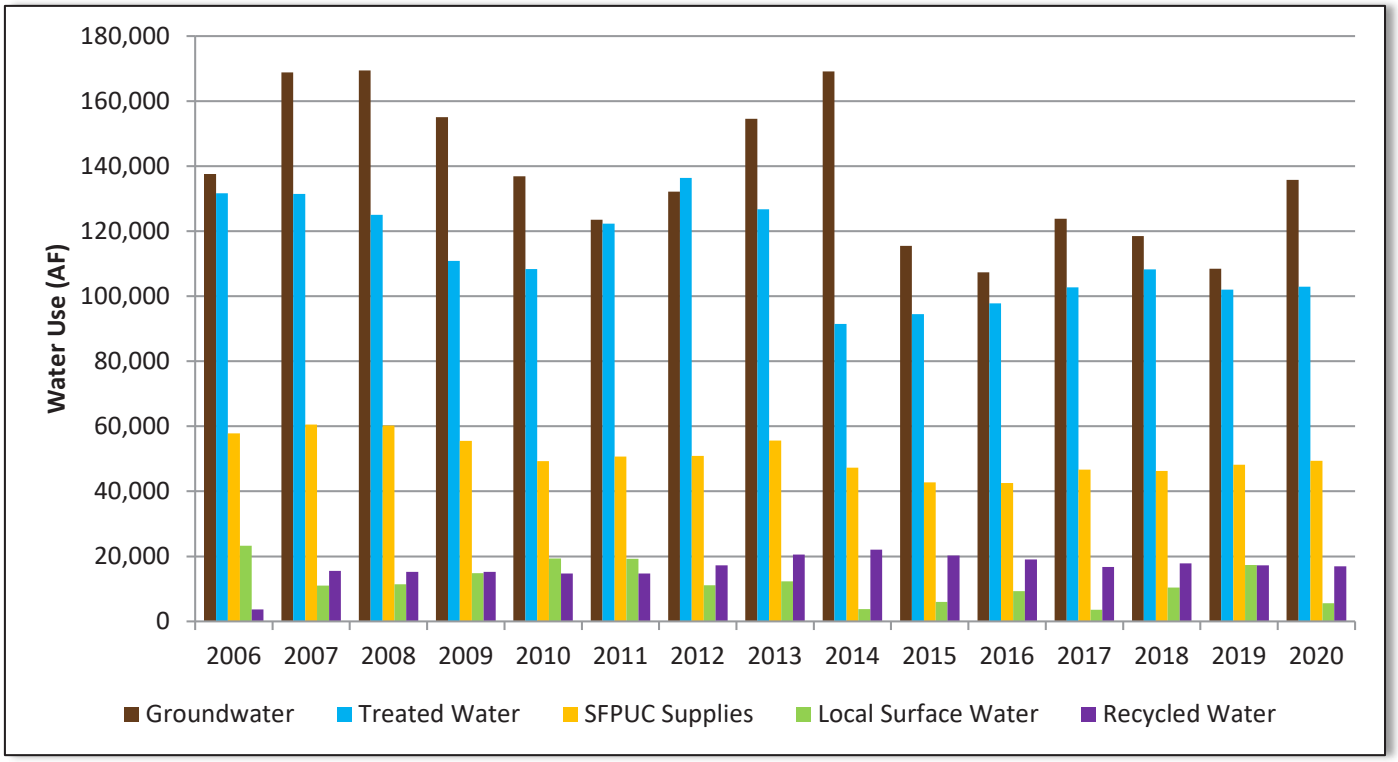


Figure 7. Groundwater Pumping by Use Category

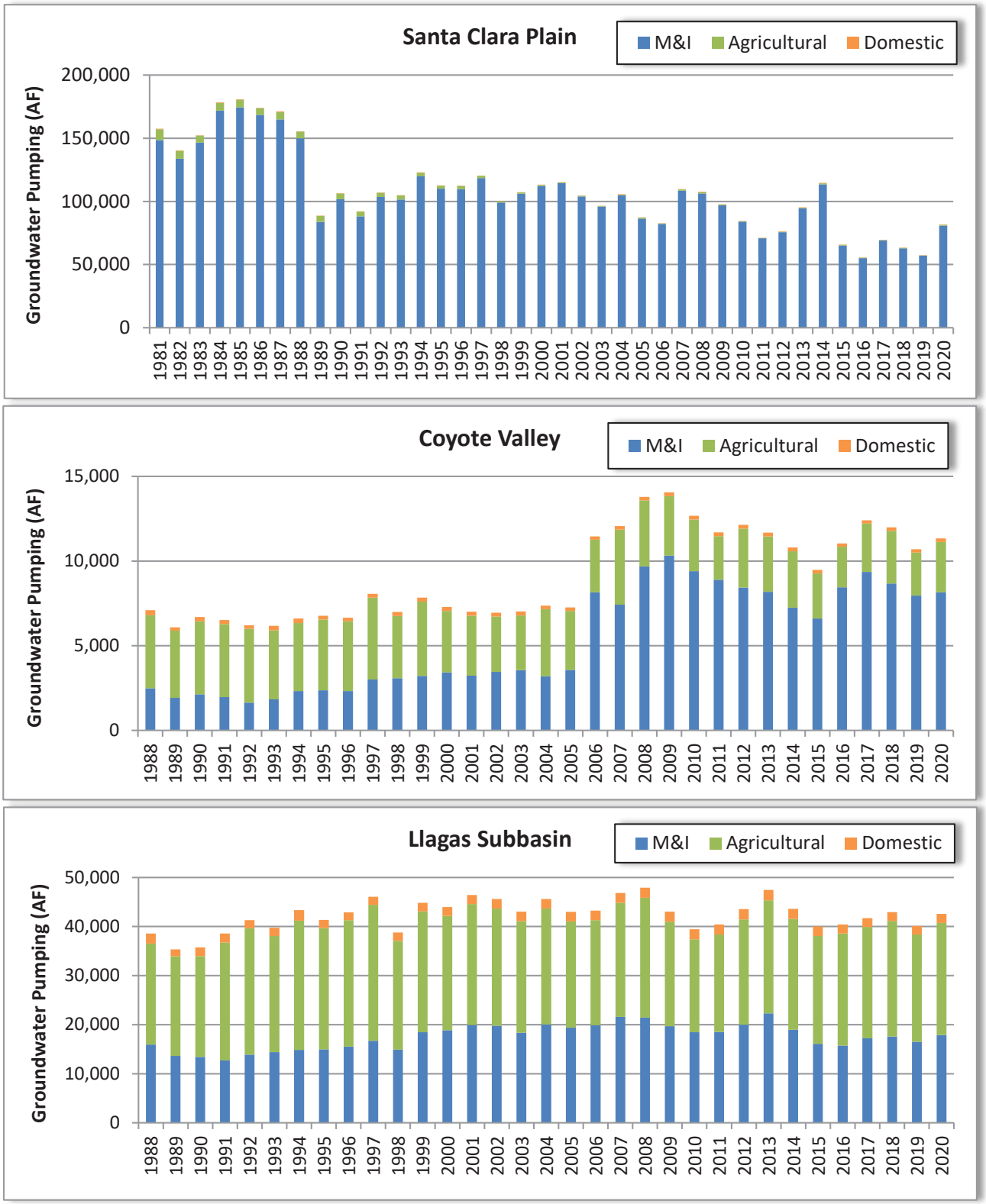
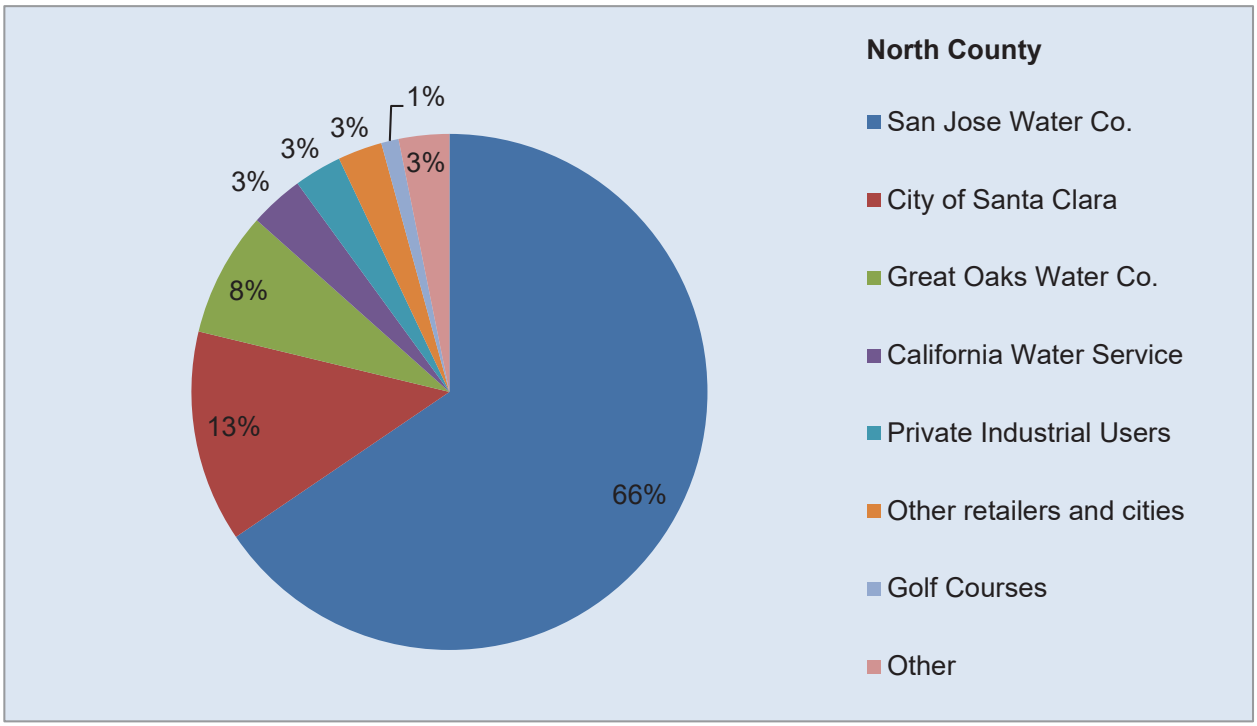
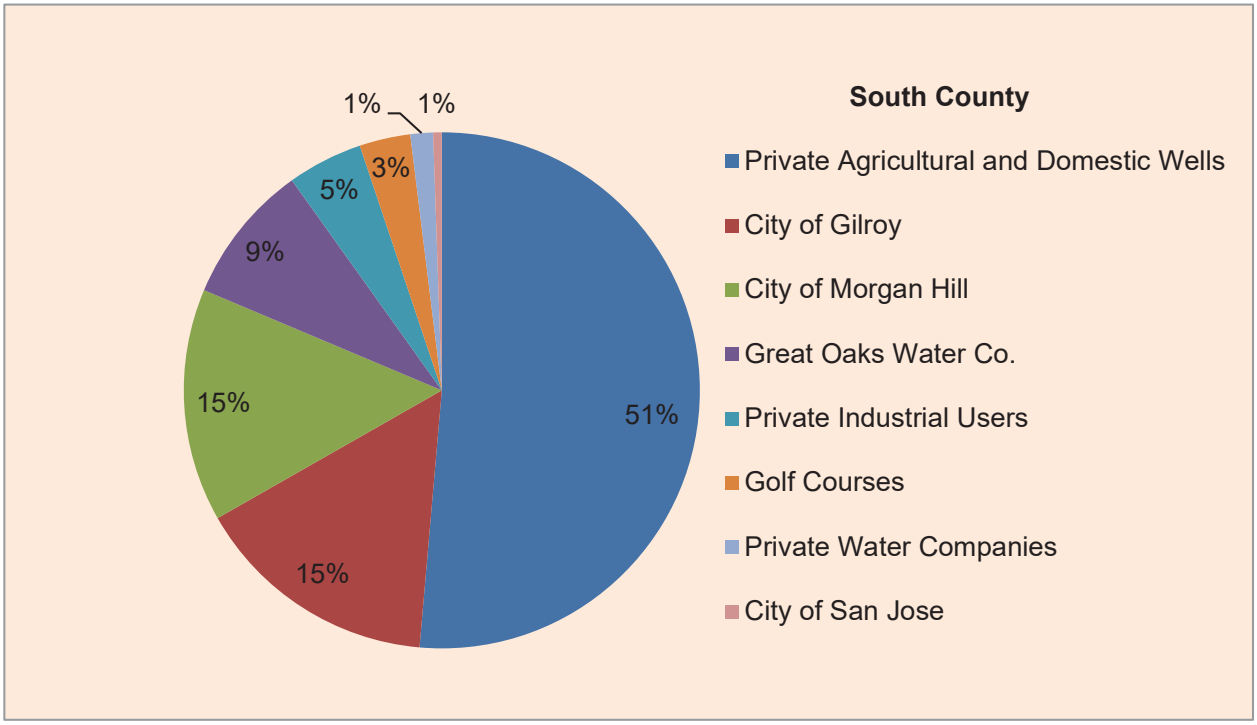


Figure 8. Percent of Total Pumping by Major Groundwater Users in 2020

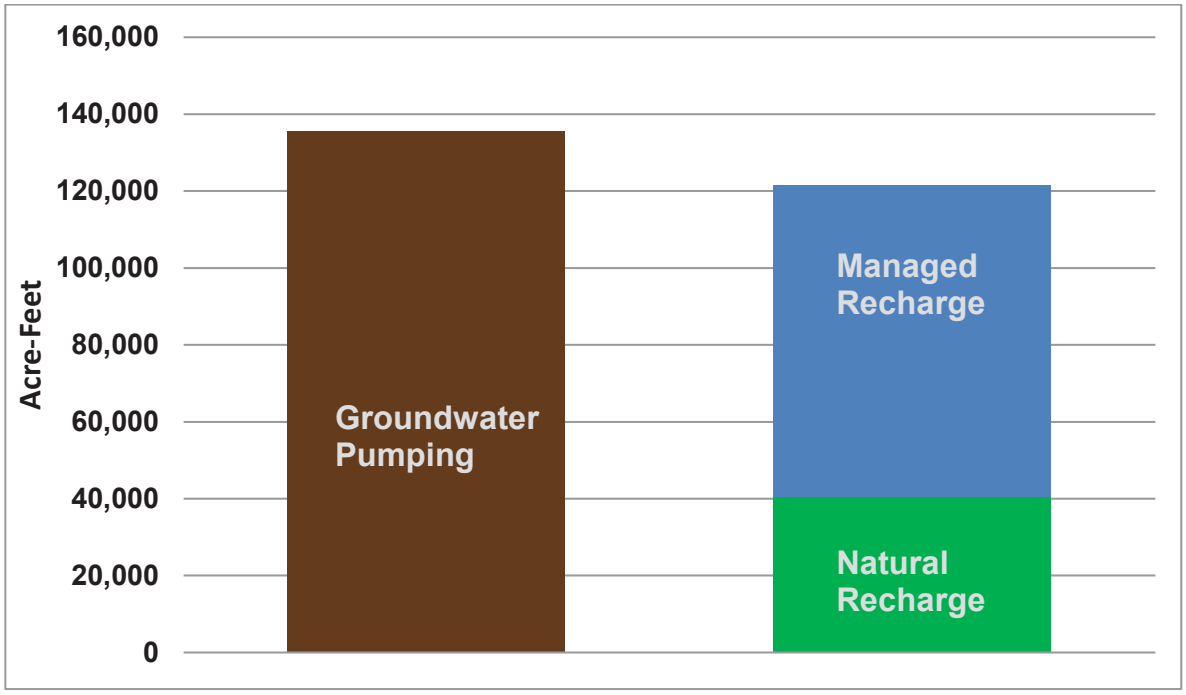




2.2 Groundwater Recharge

Since the 1930s, Valley Water's water supply strategy has been to maximize the conjunctive management of surface water and groundwater. Annual groundwater pumping far exceeds what is replenished naturally, so Valley Water ensures long-term sustainability with its managed recharge and in-lieu recharge activities. Pumping exceeded total recharge in 2020 (Figure 9) due to increased pumping and below average rainfall.

Figure 9. Countywide Groundwater Pumping and Recharge in CY 2020



Managed Recharge

Valley Water replenishes groundwater with imported water and with surface runoff captured in 10 local reservoirs. Recharge facilities include more than 277 acres of recharge ponds and over 91 miles of controlled in-stream recharge (Figure 10). Imported water sources include the Federal Central Valley Project (CVP) and the State Water Project (SWP). The relative amounts of imported or local water used for managed recharge each year depend on many factors including hydrology, imported water allocations, water treatment plant demands, and environmental needs. In general, a greater percentage of local water is used for recharge in wet years due to increased capture of storm runoff in local reservoirs.

Valley Water recharged 81,100 AF of local and imported surface water in 2020 (Table 4), which is less than the long-term average of 95,000 AF. In North County, Valley Water operated a reduced managed recharge program in early 2020, leaving many percolations ponds dry due to healthy groundwater conditions (including strong artesian pressures near the bay). The managed recharge program was increased in the latter part of 2020 as dry hydrologic conditions developed. Countywide, most of the managed recharge (80%) occurred in-stream, with the remainder through percolation ponds. Most

water used for managed recharge came from local sources (64% in North County and 55% in South County) (Figure 11). Overall, imported water contributed 41% to total managed recharge in CY 2020 (Figure 11).

Table 4. CY 2020 Managed Recharge (AF)

Zone	In-Stream Recharge (Creeks)	Off-Stream Recharge (Recharge Ponds)	Total
North County	30,700	13,300	44,000
South County	34,000	3,100	37,100
TOTAL	64,700	16,400	81,100

Figure 10. Valley Water Managed Recharge Facilities

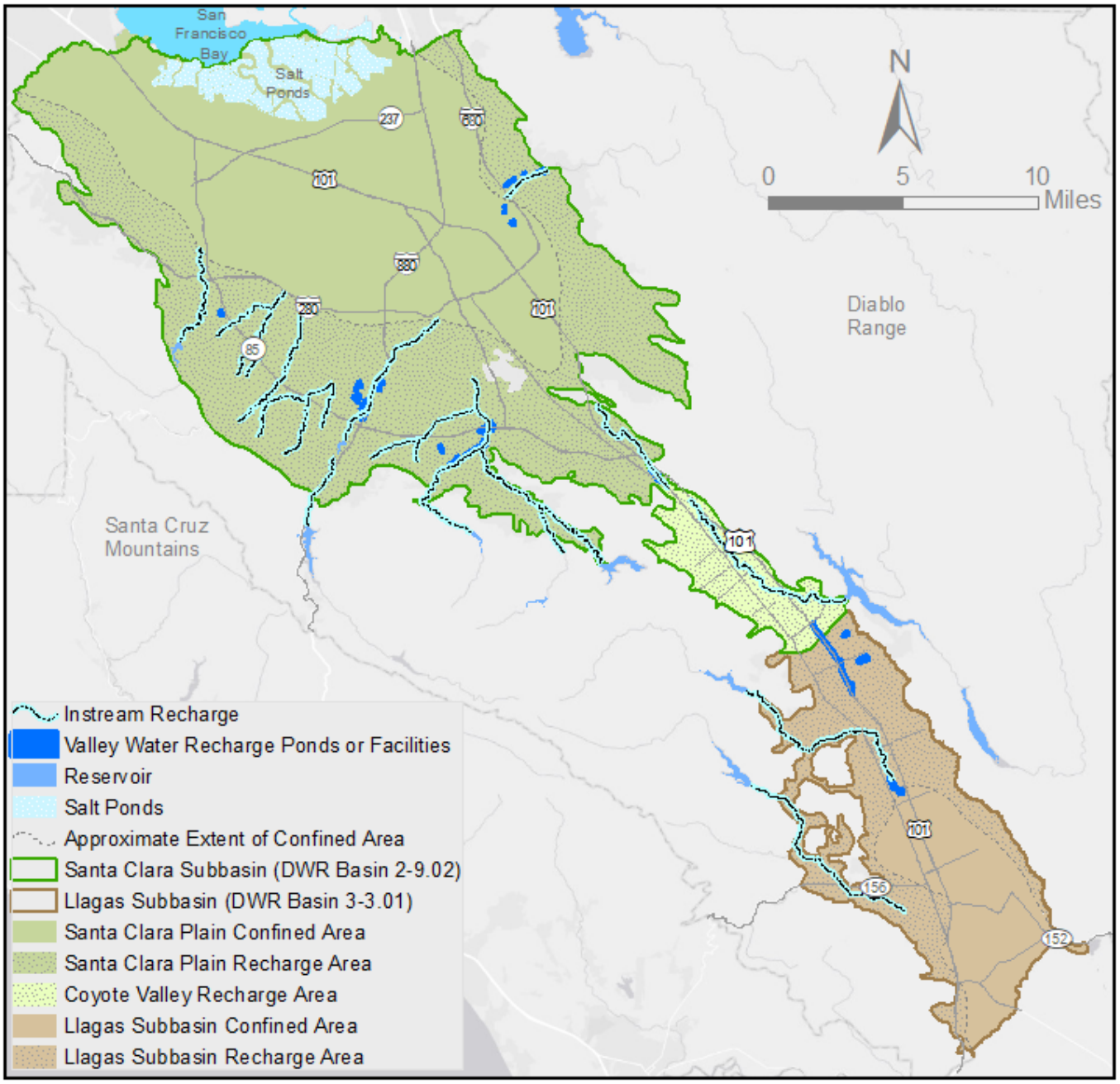
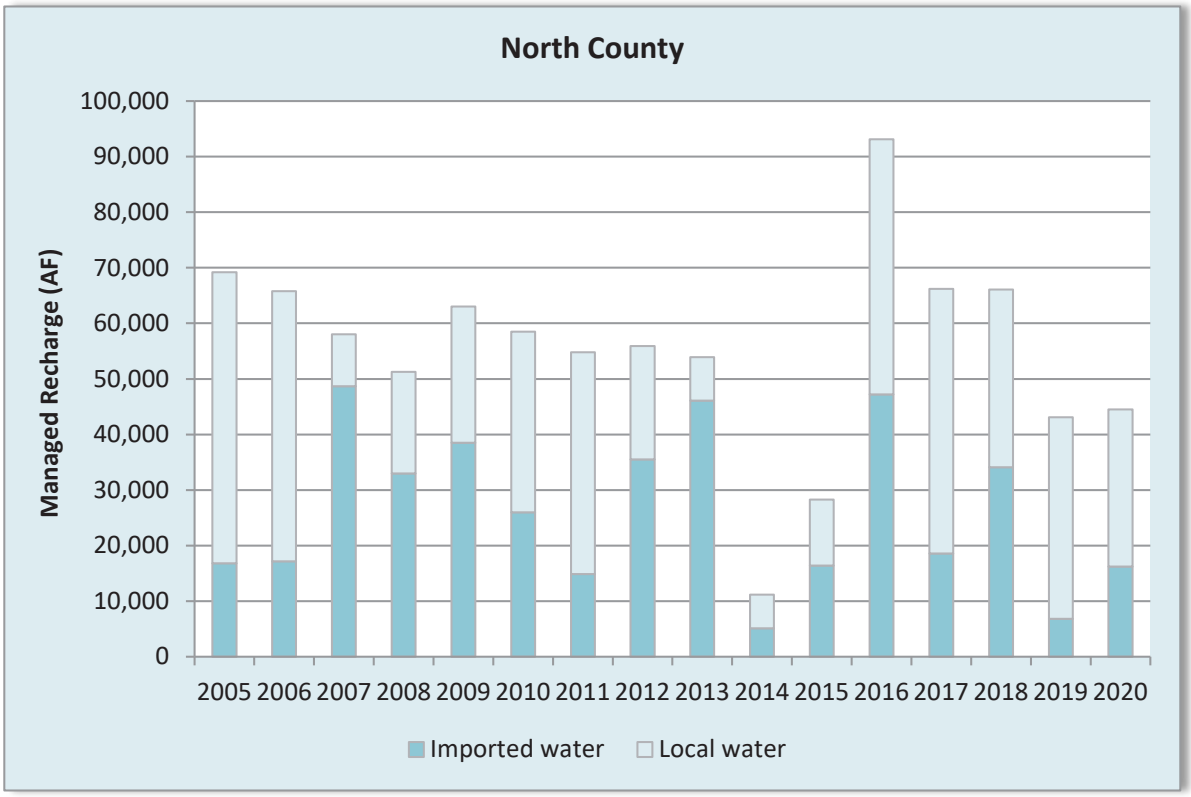
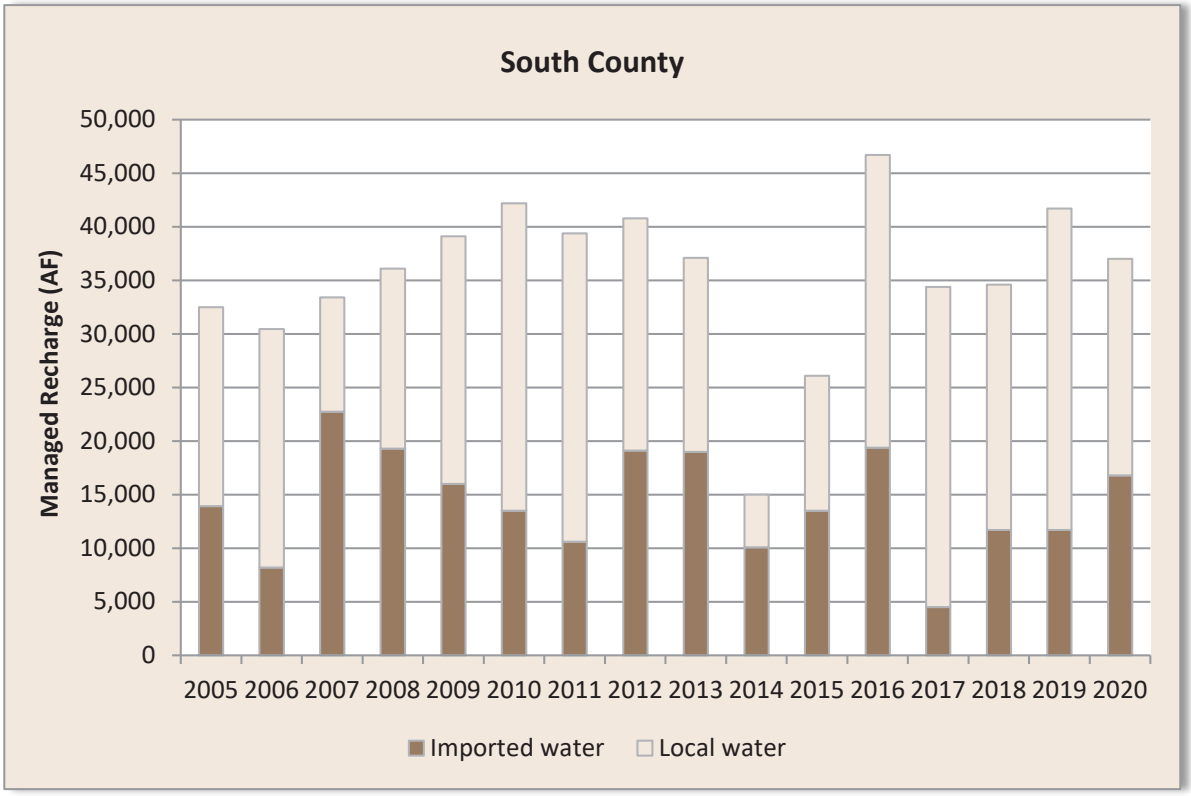


Figure 11. Managed Recharge by Source - North County and South County





Valley Water's 10 reservoirs were constructed in the 1930s and 1950s. Operating restrictions have been imposed on five of the reservoirs while seismic stability concerns are mitigated. These dam safety operating restrictions reduce the amount of water that can be stored for groundwater recharge by 55,000 AF but are needed to provide an adequate level of public safety. The restrictions result in a loss of about one third of the total surface storage capacity of Valley Water reservoirs. Current or upcoming Valley Water facility projects include seismic upgrades of Anderson, Calero, and Guadalupe dams, rehabilitation of Almaden Dam outlet works, replacement of Almaden Dam spillway, and rehabilitation of the Almaden-Calero Canal. The first phase of the seismic investigations of Coyote, Chesbro, and Uvas dams was concluded in 2019. The design of the Anderson Dam Seismic Retrofit Project (ADSRP) has progressed in 2020.

In 2020, the Federal Energy Regulatory Committee (FERC) ordered Valley Water to drain Anderson Reservoir to deadpool (3% of capacity and the lowest level that can be reached through releases from the existing outlet pipe) beginning in October 2020, to prepare for the reconstruction of the existing earthen Anderson Dam. The reconstruction is expected to last about 10 years and will allow Anderson Reservoir to return to its full operating capacity once completed. Resolving dam safety issues that currently restrict reservoir storage is also an essential component of Valley Water's comprehensive managed recharge program.

In-Lieu Recharge

Valley Water's treated water deliveries, water conservation, and recycled water programs play a critical role in maintaining groundwater storage by reducing the demand on groundwater. In 2020, treated water and recycled water provided 103,000 and 17,000 AF, respectively. Valley Water's long-term water conservation programs also saved approximately 75,000 AF.[2]

Valley Water's Silicon Valley Advanced Water Purification Center began operating in 2014. This state-of-the-art facility in San Jose produces up to 8 million gallons per day, or 9,000 AF per year, of highly purified water by treating recycled water with microfiltration, reverse osmosis, and ultraviolet light. This purified water is then blended with tertiary-treated recycled water to improve the quality for landscape irrigation and industrial uses. This facility supports Valley Water's goal of expanding the use of recycled and purified water, which reduces the demand on groundwater and increases supply reliability.

2.3 Groundwater Balance

While groundwater storage may increase or decrease each year, Valley Water's comprehensive managed and in-lieu recharge programs ensure a long-term balance. The annual groundwater balance presented in Figure 12 evaluates annual inflows and outflows for the Santa Clara Plain, Coyote Valley, and Llagas Subbasin. It should be noted that some terms presented in the groundwater balance cannot be directly measured and represent estimated values from Valley Water's calibrated groundwater flow models.

[2] Santa Clara Valley Water District, Protection and Augmentation of Water Supplies, FY 2021-22 (PAWS), 50th Annual Report, February 2021.

Inflows

Major inflows to the subbasins are primarily controlled by hydrologic conditions that include:

- Managed recharge by Valley Water, using local and imported surface water; and
- Natural recharge, which includes deep percolation of rainfall, natural seepage through creeks, subsurface inflow from adjacent aquifers, water loss from transmission and distribution lines, mountain front recharge, and return flows from septic systems and irrigation

Valley Water quantifies managed recharge using streamflow measurements and measured releases from reservoirs and raw water pipelines. Rainfall is measured at precipitation gage stations in San Jose (NOAA[3] Station USW00023293), Los Gatos (NOAA Station USC00045123), and Morgan Hill (Valley Water Station 41). These stations provide rainfall data used in each of Valley Water's three calibrated numerical groundwater flow models (MODFLOW) for the Santa Clara Plain, Coyote Valley, and Llagas Subbasin. Subsurface inflows and outflows to and from adjacent aquifer systems and mountain front recharge are derived from Valley Water's calibrated groundwater flow models. Total inflow to all subbasins was 128,000 AF in 2020, with managed recharge providing 63% of total inflows (Figure 12).

Both locally and statewide, 2020 precipitation was below normal and resulted in less natural recharge and low surface water runoff. Estimated natural recharge in 2020 was 40,400 AF, approximately 30% lower than in 2019.

Outflows

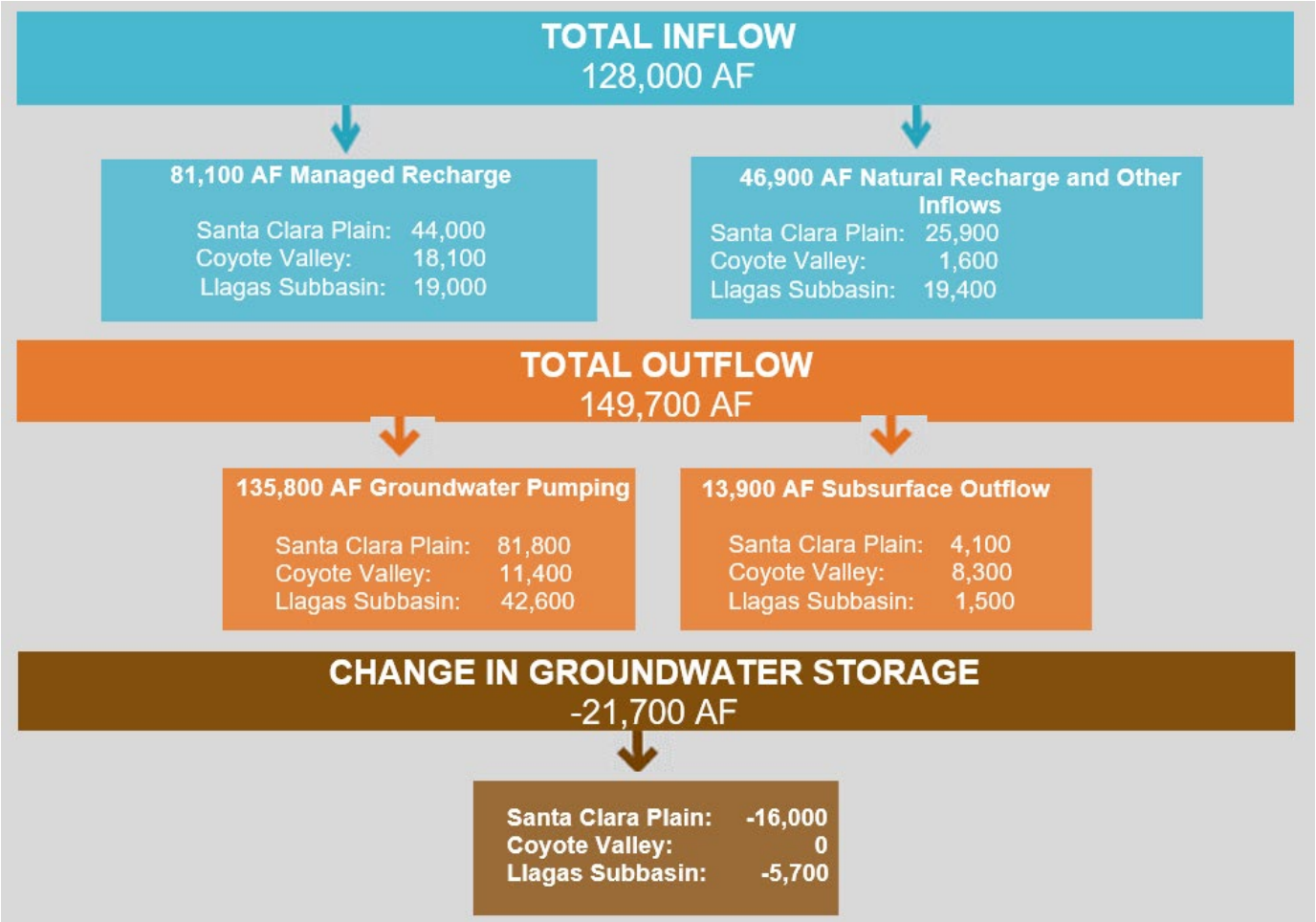
The primary outflow of groundwater is pumping, which was 135,800 AF and accounted for about 91% of the total outflow of 149,700 AF in 2020. Most groundwater pumped is metered. In Zone W-2, meters are required for wells pumping more than 1 acre-feet per year (AFY) of non-agricultural water or 4 AFY of agricultural water annually. In Zones W-5, W-7, and W-8, meters are required for wells producing more than 2 AFY of non-agricultural water or 20 AFY of agricultural water. Where meters are not installed, crop factors are used to estimate agricultural water use, whereas domestic use is estimated from a table of average uses. Subsurface outflow to adjacent aquifer systems, creeks, storm and sewer systems, and plant uptake was 13,900 AF, or 9% of the total outflow.

Change in Storage

There was an estimated decrease in countywide storage of 21,700 AF in 2020 because the groundwater outflows exceeded the inflows (Figure 12). Compared to 2019, storage in the Santa Clara Plain and the Llagas Subbasin decreased by 16,000 AF and 5,700 AF, respectively. Storage in the Coyote Valley was the same as in 2019 (Figure 12). This resulted in a total estimated end of year storage of about 337,100 AF in 2020. This is well within the "Normal" stage of Valley Water's Water Shortage Contingency Plan, which represents storage above 300,000 AF. Groundwater levels and storage are described in more detail in Chapter 3.

[3] U.S. Department of Commerce National Oceanic and Atmospheric Administration (NOAA).

Figure 12. CY 2020 Groundwater Balance



Notes:

1. Groundwater balance terms presented are estimates as of June 2021. These estimates are refined as additional data becomes available. Values shown are based on measured quantities or calibrated groundwater flow models, with all values rounded to the nearest 100 AF.
2. Managed recharge represents direct replenishment by Valley Water using local and imported water. Estimates from the groundwater models may differ slightly from surface water accounting estimates.
3. Natural recharge and other inflows include the deep percolation of rainfall, septic system and/or irrigation return flows, natural seepage through creeks, storm and sewer system seepage, and inflow from adjacent aquifer systems.
4. The groundwater pumping estimate is based on pumping metered by Valley Water or reported by low-volume groundwater users.
5. Subsurface outflow represents outflow to adjacent aquifer systems. In the Santa Clara Plain, this includes outflows to San Francisco Bay; in the Coyote Valley, this includes outflow to the Santa Clara Plain; and in the Llagas Subbasin, this includes outflows to the North San Benito Subbasin in San Benito County.

CHAPTER 3

Groundwater Levels and Storage

CHAPTER 3 – GROUNDWATER LEVELS AND STORAGE

Groundwater levels throughout the county declined in 2020 due to drought conditions. Groundwater reserves decreased by an estimated 21,700 AF during 2020 because pumping and other outflows exceeded total recharge. The estimated end of 2020 groundwater storage was 337,100 AF, which was in the normal stage of Valley Water's Water Shortage Contingency Plan and was well above the Groundwater Management Plan (GWMP) storage target of 300,000 AF. Looking forward, the projected end of year storage for 2021 is expected to be above the 300,000 AF target as well.

3.1 Groundwater Levels

Comprehensive and accurate groundwater level data allows Valley Water to evaluate storage conditions and supports good operational decisions and water supply planning. In 2020, Valley Water measured depth to water at 229 wells on a daily to monthly basis and obtained similar data from 119 water retailer wells (Figure 13). The wells Valley Water monitors represent all critical areas and aquifers in each of the subbasins. As the designated monitoring entity for Santa Clara County under the California Statewide Groundwater Elevation Monitoring (CASGEM) program, Valley Water uploaded over 1,200 groundwater elevation measurements for 129 wells to the CASGEM website in 2020.

Three groundwater level index wells are used to represent broad regional conditions in the Santa Clara Plain, Coyote Valley, and Llagas Subbasin (locations in Figure 13 and hydrographs in Figure 14). Table 5 shows February and October 2020 groundwater elevations for the index wells; these months typically represent the seasonal high and low groundwater elevations, respectively. Compared to 2019, the 2020 average groundwater elevation was 16 feet lower in the Santa Clara Plain, 6 feet lower in the Coyote Valley, and 12 feet lower in the Llagas Subbasin. Groundwater elevations remained well above the historically lowest levels as well as above the levels during the drought of 1987-1992 (Figure 14). Additionally, groundwater elevations were well above the thresholds established to minimize the risk of land subsidence in all subsidence monitoring index wells throughout 2020.[1] All available groundwater elevation and depth-to-water data can be accessed on Valley Water's website at valleywater.org/groundwater

[1] To avoid resumption of permanent subsidence, Valley Water has established subsidence thresholds at ten index wells in the Santa Clara Plain as described further in Chapter 4.

Table 5. Groundwater Elevations at Regional Index Wells (feet, NGVD88)

Groundwater Subbasin/Area	Index Well	February 2020	October 2020	2020 Average	2019 Average	5-Year Average (2016-2020)	Period of Record Average
Santa Clara Subbasin, Santa Clara Plain	07S01W25L001	85.6	66.5	74.5	90.7	86.2	17.4
Santa Clara Subbasin, Coyote Valley	09S02E02J002	272.6	269.8	271.4	277.2	275.2	237.3
Llagas Subbasin	10S03E01N005	260.5	230.5	245.5	257.7	250.4	243.3

Note: The period of record for the index wells is 1936 to present for the Santa Clara Plain, 1948 to present for the Coyote Valley, and 1969 to present for the Llagas Subbasin with a change in wells from 10S03E13D003 to 10S03E13E007 in 2019 and to 10S03E01N005 in 2020. While seasonal highs often occur in March, there was no monthly measurement in March 2020 due to Covid pandemic restrictions; the value shown is for February 2020.

Groundwater elevation contours for the principal aquifer zone in spring and fall of 2020 are shown in Figures 15 and 16. The spring and fall maps were created using the water level measurements closest to March 31, 2020, and September 30, 2020, respectively. The typical seasonal pattern observed is that groundwater levels peak in the early spring due to winter rainfall recharge and low pumping and then decline through the summer and fall due to increased pumping and less natural recharge; groundwater levels then usually start rising with the late fall and winter rains.

In the Santa Clara Subbasin, the general groundwater flow direction is northwest from the Coyote Valley toward San Francisco Bay. Valley Water's managed recharge program helps maintain adequate pressures in the principal aquifer zone such that groundwater flows toward the bay and maintains an upward vertical gradient near the bay. The upward gradient minimizes the potential for seawater intrusion into the principal aquifers. Artesian conditions occur in the confined area of the Santa Clara Plain and, in 2020, many wells had substantial artesian pressure.

The 2020 groundwater flow patterns observed in South County were similar to those observed in the past. In Coyote Valley, the highest elevations are at the groundwater divide between the Santa Clara Subbasin and the Llagas Subbasin near Cochrane Road and groundwater generally flows toward the northwest. The highest groundwater elevations in the Llagas Subbasin are in the recharge area in Morgan Hill, again near Cochrane Road, and groundwater generally flows southeast toward the Pajaro River and San Benito County. Managed and natural recharge within the recharge area maintains groundwater pressures within the southern confined area, where deeper groundwater occurs in partially to fully confined (artesian) conditions. Similar to the Santa Clara Plain, artesian pressures in the Llagas Subbasin were maintained in some wells in 2020.

Figure 13. CY 2020 Groundwater Level Monitoring

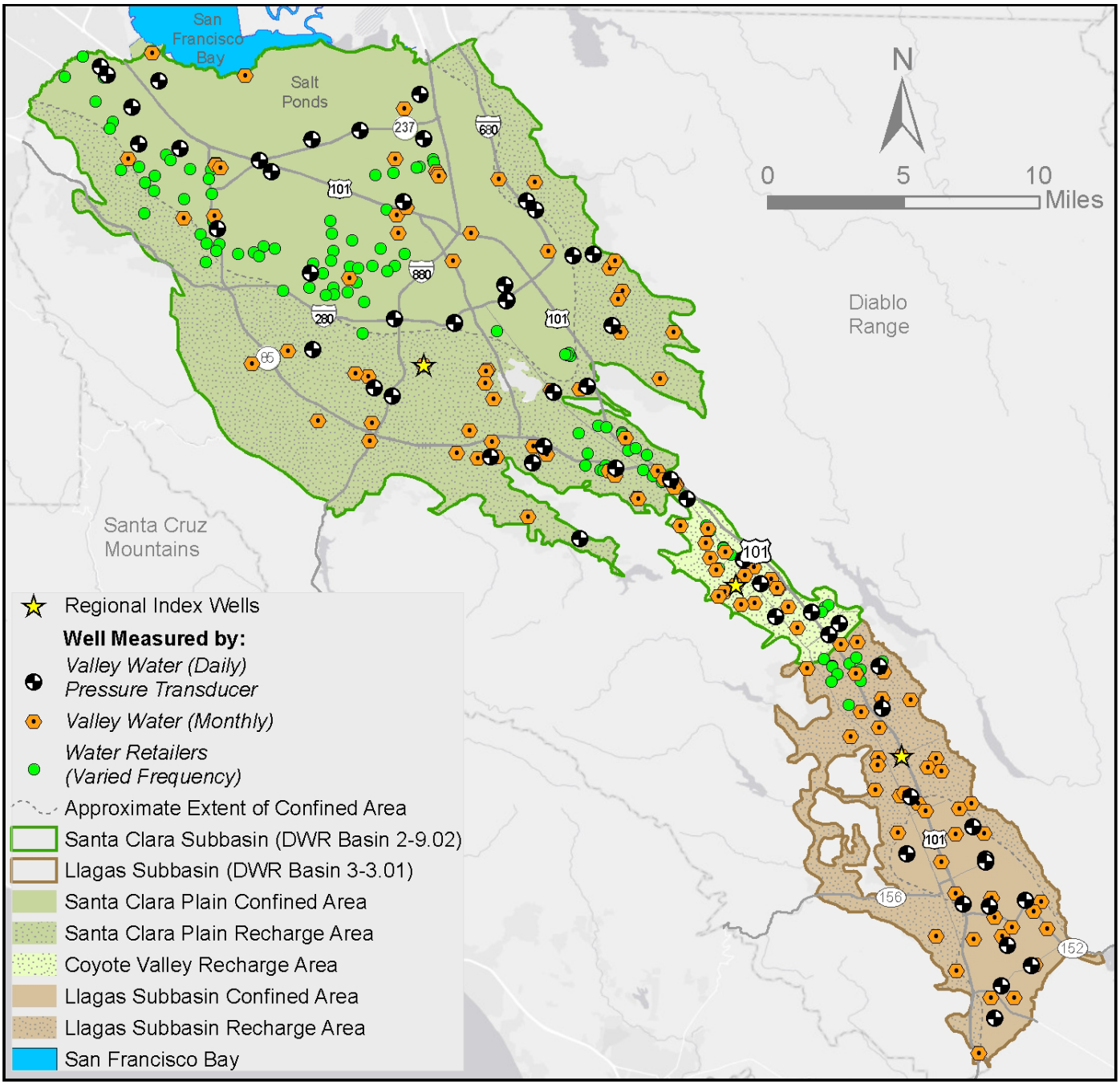
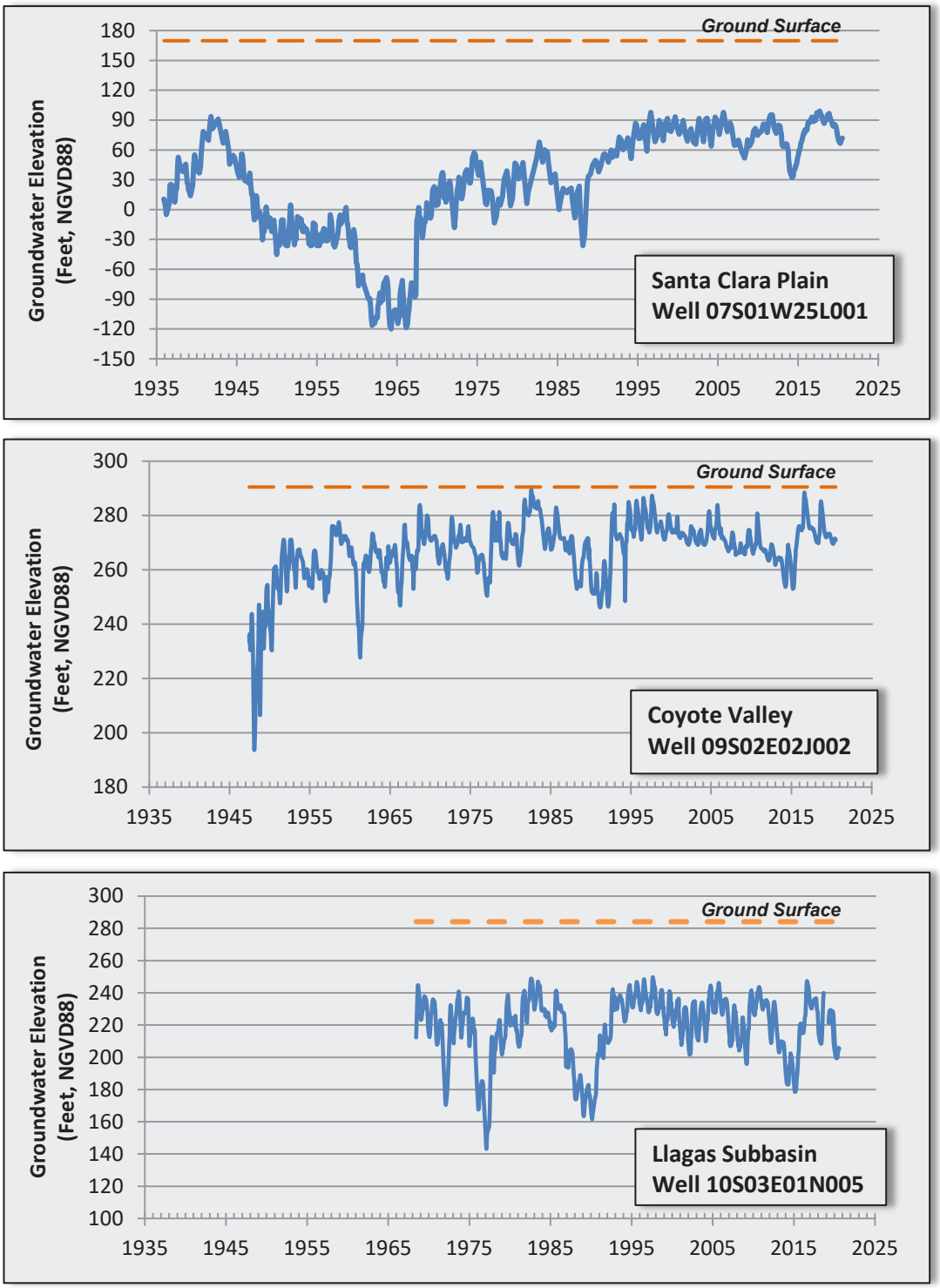


Figure 14. Groundwater Elevations at Regional Index Wells



Note: The original Llagas Subbasin regional index well (10S03E13D003) was destroyed by the owner in April 2019 and was replaced in November 2019 by Valley Water with well 10S03E13E007. Due to an apparent obstruction, well 10S03E13E007 was replaced in December 2020 with 10S03E01N005, based on proximity to and similarities in the well construction and water level hydrographs as the original well 10S03E13D003.

Figure 15. Spring 2020 Groundwater Elevation Contours in the Principal Aquifers

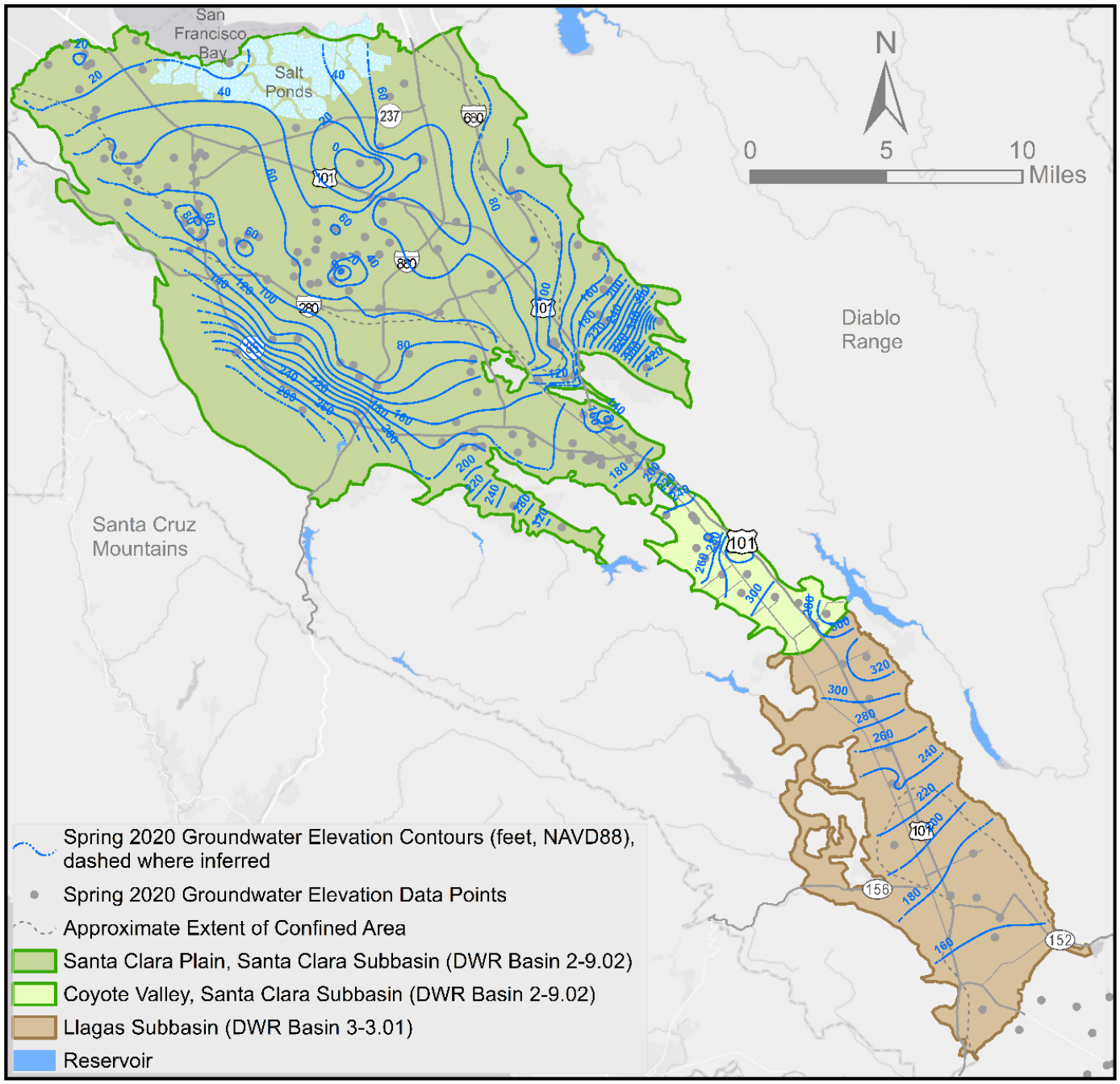
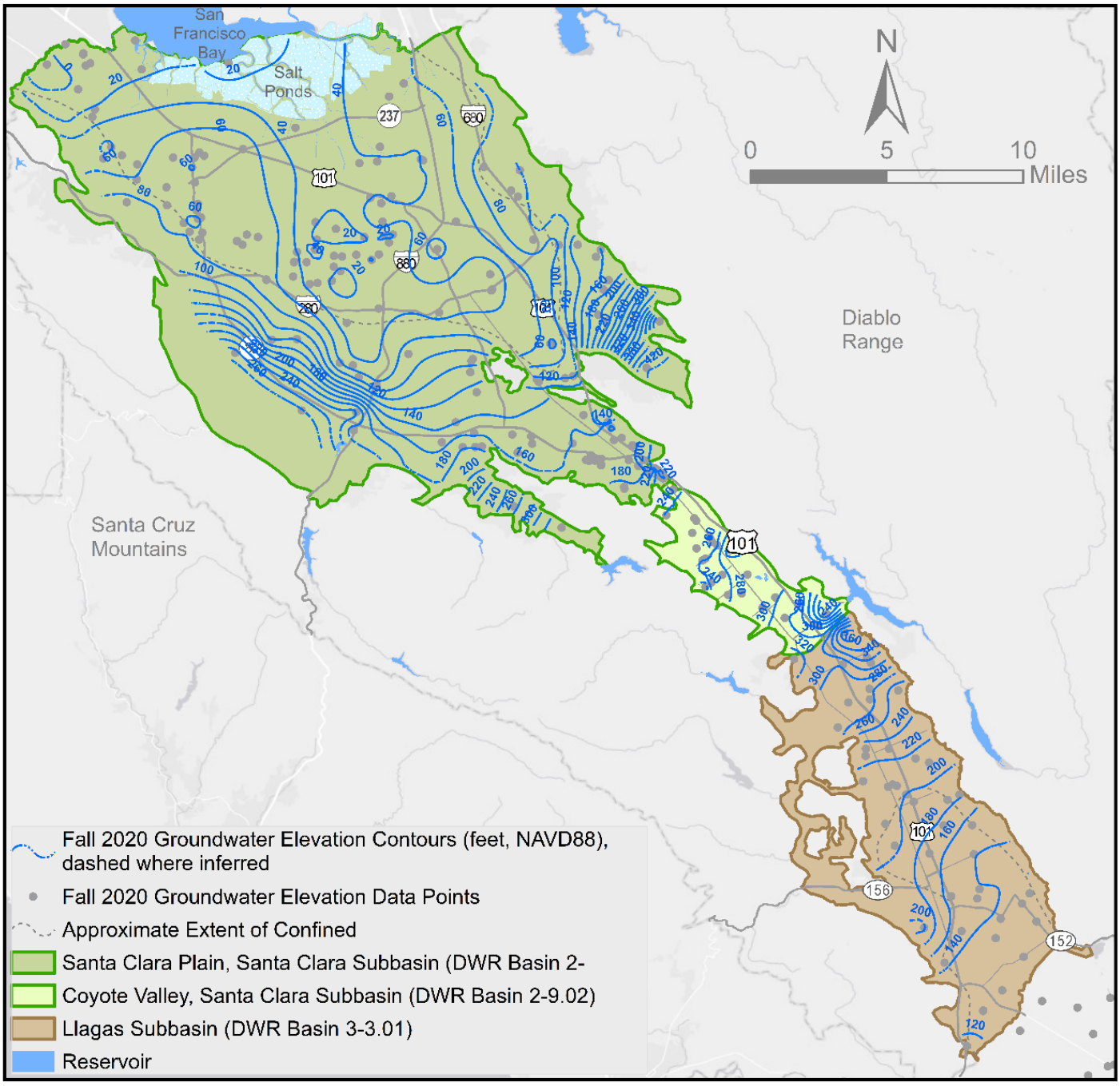


Figure 16. Fall 2020 Groundwater Elevation Contours in the Principal Aquifers



3.2 Groundwater Storage

Estimated countywide groundwater storage at the end of 2020 was 337,100 AF; this is well above the GWMP outcome measure of 300,000 AF, but 21,700 AF lower than 2019 (Table 6). End of year groundwater storage above 300,000 AF falls within the normal stage (Stage 1) of Valley Water's Water Shortage Contingency Plan. The end of year storage for 2021 is projected to be above the 300,000 AF target as well.

Table 6. Estimated End of Year Groundwater Storage (AF)

Groundwater Subbasin/Area	GWWP Outcome Measure	End of Year 2019	End of Year 2020	Change in Storage
Santa Clara Subbasin, Santa Clara Plain	278,000	316,000	300,000	-16,000
Santa Clara Subbasin, Coyote Valley	5,000	13,400	13,400	No Change
Llagas Subbasin	17,000	29,400	23,700	-5,700
TOTAL	**300,000**	**358,800**	**337,100**	**-21,700**

Note: Groundwater storage estimates presented are as of December 2020. These estimates are based on accumulated groundwater storage since 1970, 1991, and 1990 for the Santa Clara Plain, Coyote Valley, and Llagas Subbasin, respectively. These estimates are refined as additional pumping and managed recharge data become available.

Groundwater Storage Outcome Measures

Valley Water met each of the three storage outcome measures in 2020 as shown below.

OM 2.1.1.a. Greater than 278,000 AF of projected end of year groundwater storage in the Santa Clara Plain. **Outcome measure met**: End of 2020 groundwater storage is 300,000 AF.

OM 2.1.1.b. Greater than 5,000 AF of projected end of year groundwater storage in the Coyote Valley. **Outcome measure met**: End of 2020 groundwater storage is 13,400 AF.

OM 2.1.1.c. Greater than 17,000 AF of projected end of year groundwater storage in the Llagas Subbasin. **Outcome measure met**: End of 2020 groundwater storage is 23,700 AF.

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CHAPTER 4

Land Subsidence

CHAPTER 4 – LAND SUBSIDENCE

Subsidence is a concern due to historical occurrence in the Santa Clara Plain and because it can lead to an increased risk of flooding, seawater intrusion into groundwater, and can damage settlement-sensitive infrastructure and utilities. In 2020, Valley Water monitored for subsidence at 140 benchmarks along three cross valley land surface level circuits and at two extensometers in the Santa Clara Plain. Groundwater levels at ten subsidence index wells were also monitored and compared to thresholds established at each well to minimize the risk of permanent land subsidence. The subsidence outcome measure was met in 2020 with subsidence below the threshold of 0.01 feet per year. Subsidence has never been observed in the Coyote Valley or the Llagas Subbasin, so there is no related outcome measure in those areas.

Between 1915 and 1969, land subsidence occurred in the Santa Clara Plain due to groundwater overdraft, with up to 14 feet of inelastic (permanent) land subsidence observed in City of San Jose. Inelastic subsidence was essentially halted by about 1970 through Valley Water's expanded conjunctive water management programs, which facilitated the return of groundwater to levels well above subsidence thresholds. Elastic (non-permanent) subsidence and recovery occurs annually in response to seasonal pumping and recharge as indicated by satellite studies and extensometer measurements (Appendix A).[1] To avoid resumption of inelastic subsidence, Valley Water has established subsidence thresholds at ten index wells in the Santa Clara Plain.[2] A tolerable rate of 0.01 feet per year of subsidence was used to determine thresholds at these wells.[3] These subsidence thresholds are the groundwater levels above which groundwater must be maintained to ensure a low risk of land subsidence.

Valley Water conducts ongoing monitoring of land surface benchmarks, extensometers, and groundwater levels at subsidence index wells to determine if land subsidence is occurring and threatening to exceed established thresholds. The subsidence monitoring network is shown in Figure 17. 2020 monitoring data from land benchmark surveys, extensometers, and subsidence index wells indicate that there is a low risk of subsidence, as described further below and in the 2020 Subsidence Data Analysis Technical Memorandum (Appendix A).

4.1 Extensometer Monitoring

Valley Water monitors two 1,000-foot deep extensometers that measure aquifer compaction or expansion, associated with subsidence or uplift, by comparing vertical ground elevation relative to a central, isolated pipe set beneath the water-bearing units. The extensometers, located in Sunnyvale near Moffett Field ("Sunny") and near downtown San Jose ("Martha"), are equipped with data loggers to provide hourly aquifer compaction/expansion and water level readings. Valley Water evaluates the

[1] Schmidt, D. A., and R. Bürgmann, 2003, Time-dependent land uplift and subsidence in the Santa Clara valley, California, from a large interferometric synthetic aperture radar data set, *J. Geophysical Res., 108* (B9), 2003.
[2] Geoscience Support Services Inc. for Santa Clara Valley Water District, Subsidence Thresholds in the North County Area of Santa Clara Valley, 1991.
[3] The tolerable subsidence rate of no more than 0.01 feet per year on average was endorsed by Valley Water's Water Retailer Groundwater Subcommittee.

average land subsidence measured during the last 11 years at two extensometers to determine if it meets the tolerable rate of land subsidence of 0.01 feet per year[2].

Over the last 11 years (2010 to 2020), a negative average annual rate of subsidence (-0.003 feet per year) was measured at the extensometers (Figure 18), which is indicative of uplift (or aquifer expansion) and is below the tolerable subsidence rate of 0.01 feet per year. The average annual rate for the previous 11-year period (2009 to 2019) was -0.006 feet per year. The increased value in 2020 results from declines in groundwater levels from 2019 to 2020 throughout much of the Santa Clara Plain.

4.2 Benchmark Elevation Surveys

Periodic benchmark surveys of land surface elevation have been conducted in Santa Clara County since 1912.[4] Valley Water's current benchmark leveling program consists of annual surveys along three cross valley level circuits in the Santa Clara Plain (Figure 17). In 2020, Valley Water analyzed land surface elevation data from 140 benchmarks to evaluate the spatial variability of land subsidence. 2020 survey data generally show no net change of the land surface elevation (subsidence) from 2019. Figure 19 presents the average annual change of land surface elevation along the three circuits over the last 11 years from 2010 to 2020. It shows that subsidence (indicated by negative values) was observed at some locations and uplift (indicated by positive values) at most locations. No subsidence exceeding 0.01 feet per year was observed. The tolerable rate of subsidence of 0.01 feet per year was met during this period.

4.3 Subsidence Index Wells

Groundwater level measurements are an integral part of land subsidence monitoring because declining water levels due to long-term overdraft were the driving force of historical subsidence in the Santa Clara Plain. Valley Water measures water levels at ten subsidence index wells on a daily to monthly basis to determine if water levels are nearing established subsidence thresholds. If water levels stay near or drop below subsidence thresholds for extended periods, permanent land subsidence may resume, resulting in an increased risk of flooding, seawater intrusion, and damage to infrastructure and utilities.

Figure 20 shows groundwater levels and subsidence thresholds at the ten subsidence index wells. The lowest historical water levels were generally observed in the 1960s and 1970s. Since then, groundwater levels have recovered, primarily due to Valley Water's managed recharge and in-lieu recharge programs, with only short-term declines during drought. Similar to the regional groundwater elevation index wells, 2020 average and end-of-year water levels were generally lower than that of 2019 throughout the Santa Clara Plain. However, the end-of-year water levels were still about 105 feet, on average, higher that land subsidence thresholds. Three subsidence index wells located near the Baylands continue to have upward vertical gradients and artesian conditions. In addition to keeping water levels above subsidence thresholds, maintaining an upward hydraulic gradient in the principal aquifer zone is critical for preventing shallow groundwater with elevated salts from entering the principal

[4] USGS, Land Subsidence in the Santa Clara Valley, California as of 1982, Professional Paper 497-F, 1988.

aquifer through abandoned wells and other vertical conduits. Valley Water will continue to frequently track data from the subsidence index wells to support water supply operations and planning.

Figure 17. Land Subsidence Monitoring Network

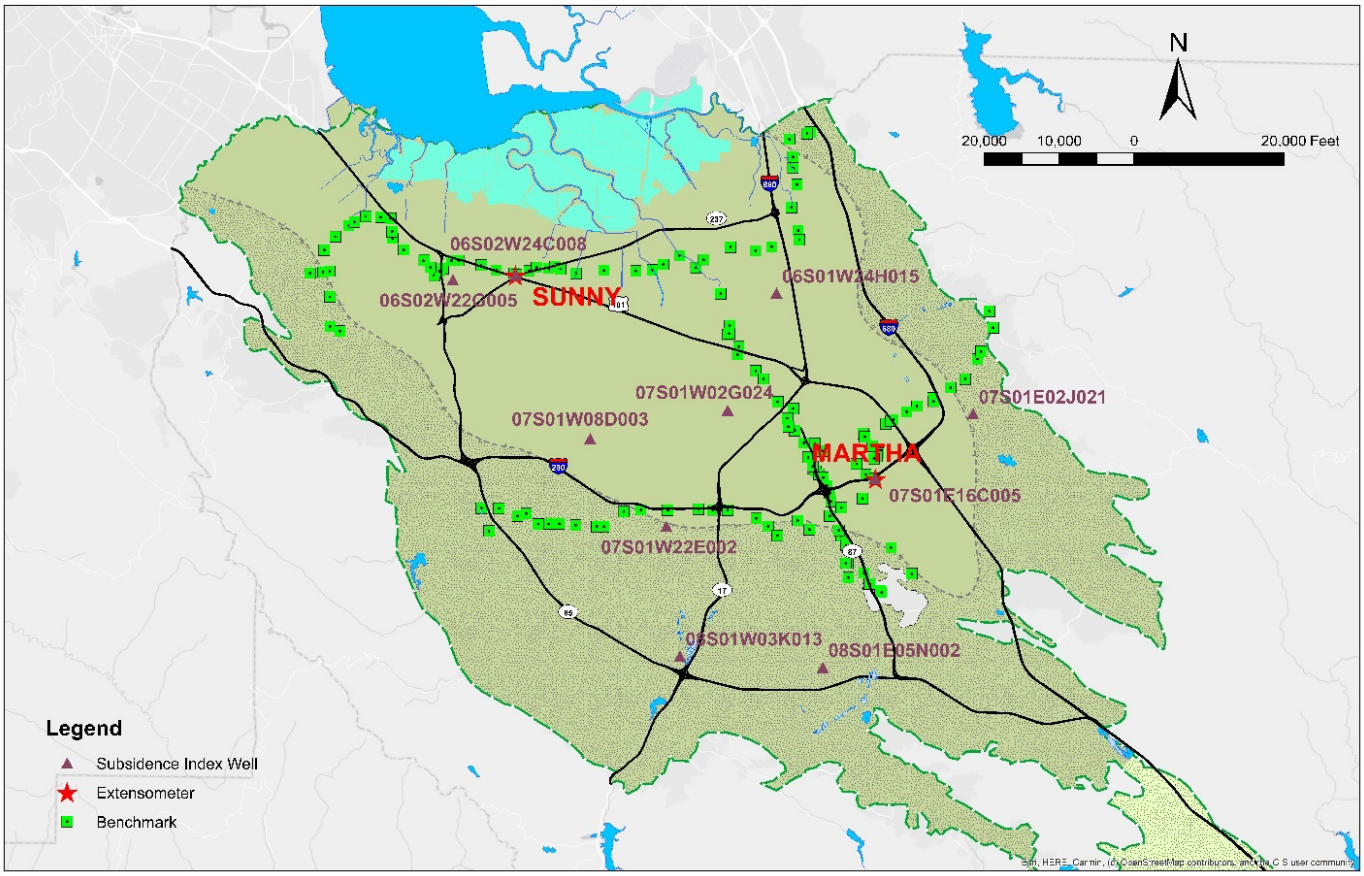


Figure 18. Cumulative Compaction at Extensometers

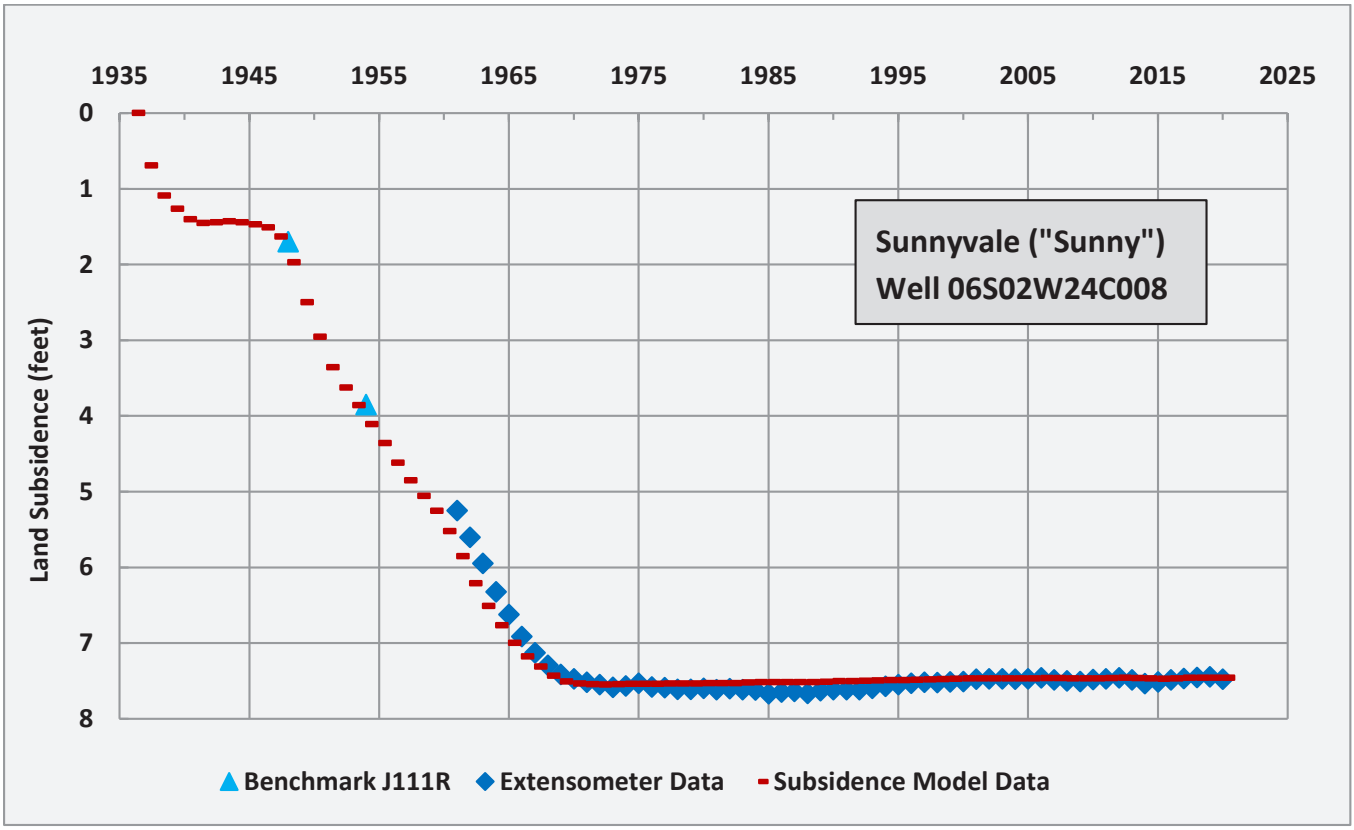


Figure 18. Cumulative Compaction at Extensometers (continued)

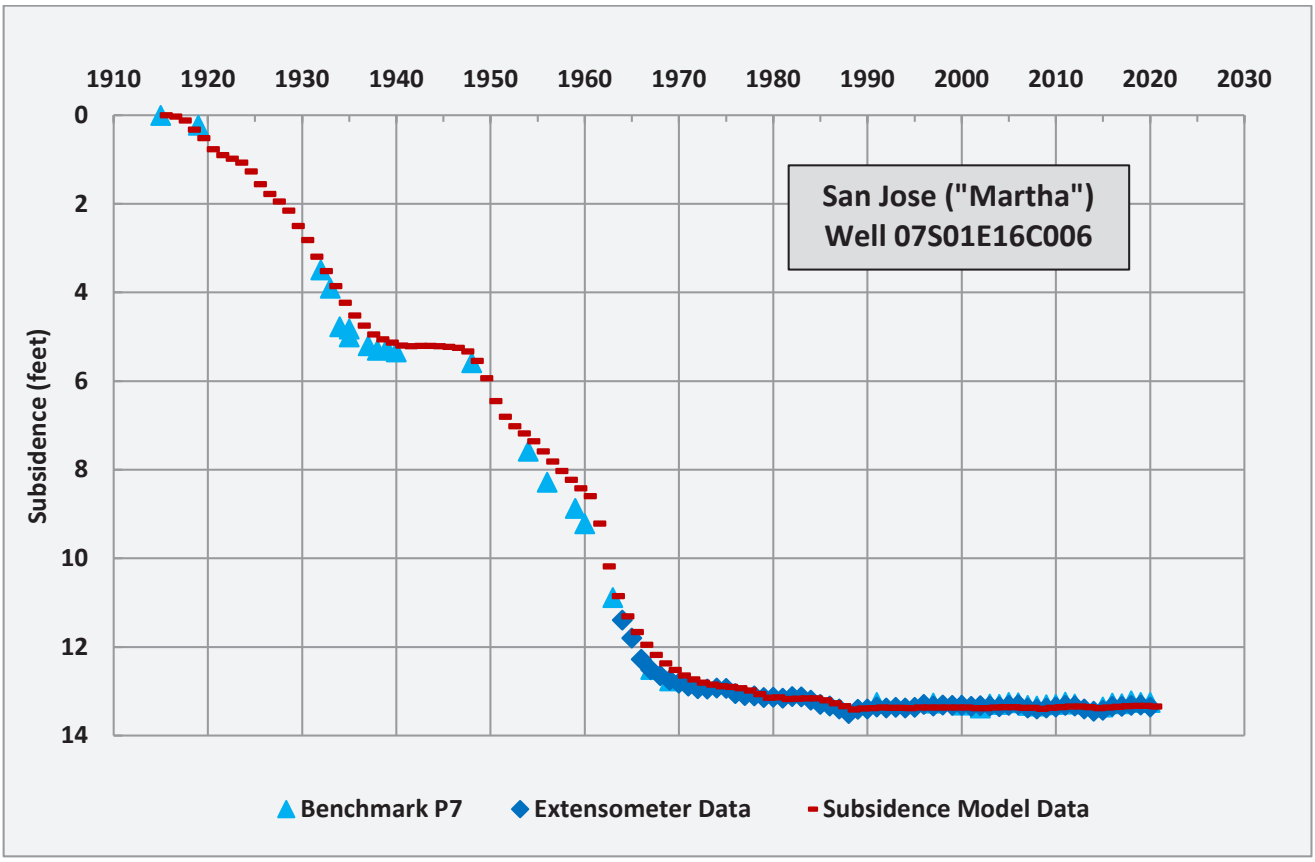
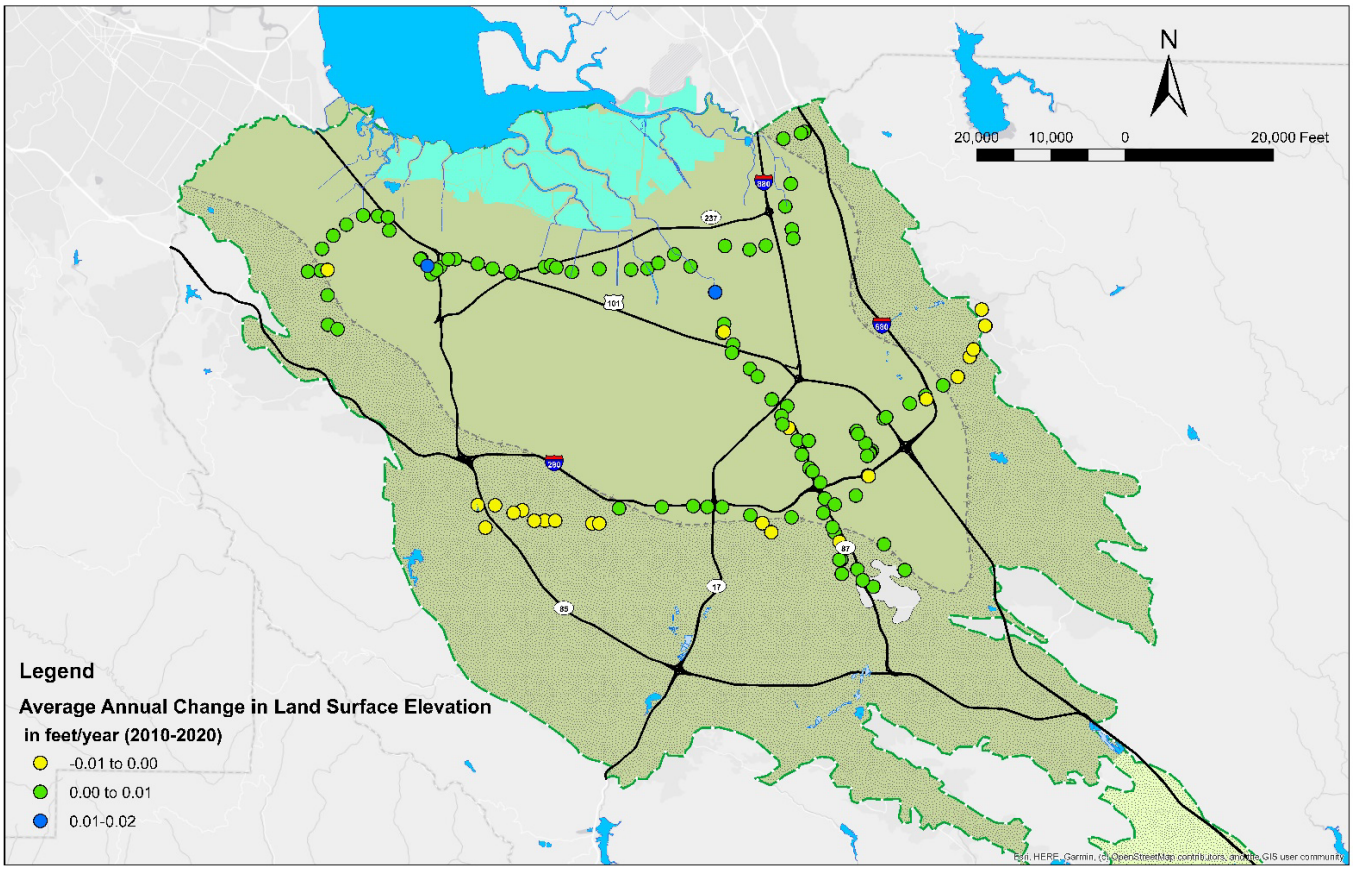


Figure 19. Average Annual Change of Land Surface Elevation Between 2010 and 2020



Note: positive values indicate land surface uplift and negative values indicate land surface subsidence.

Figure 20. Groundwater Levels at Santa Clara Plain Subsidence Index Wells (feet, NAVD88)

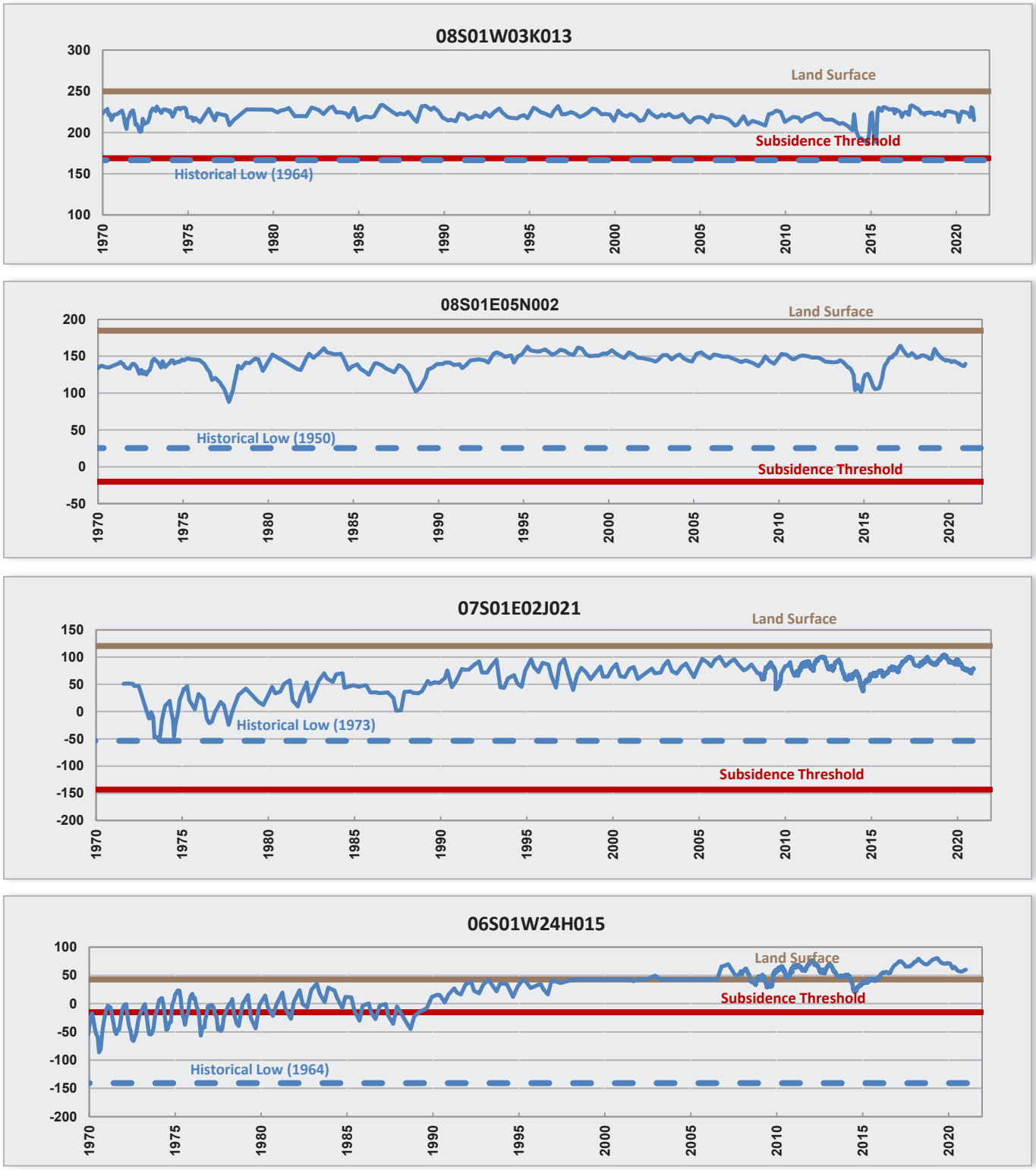


Figure 20. Groundwater Levels at Santa Clara Plain Subsidence Index Wells (feet, NAVD88 continued)

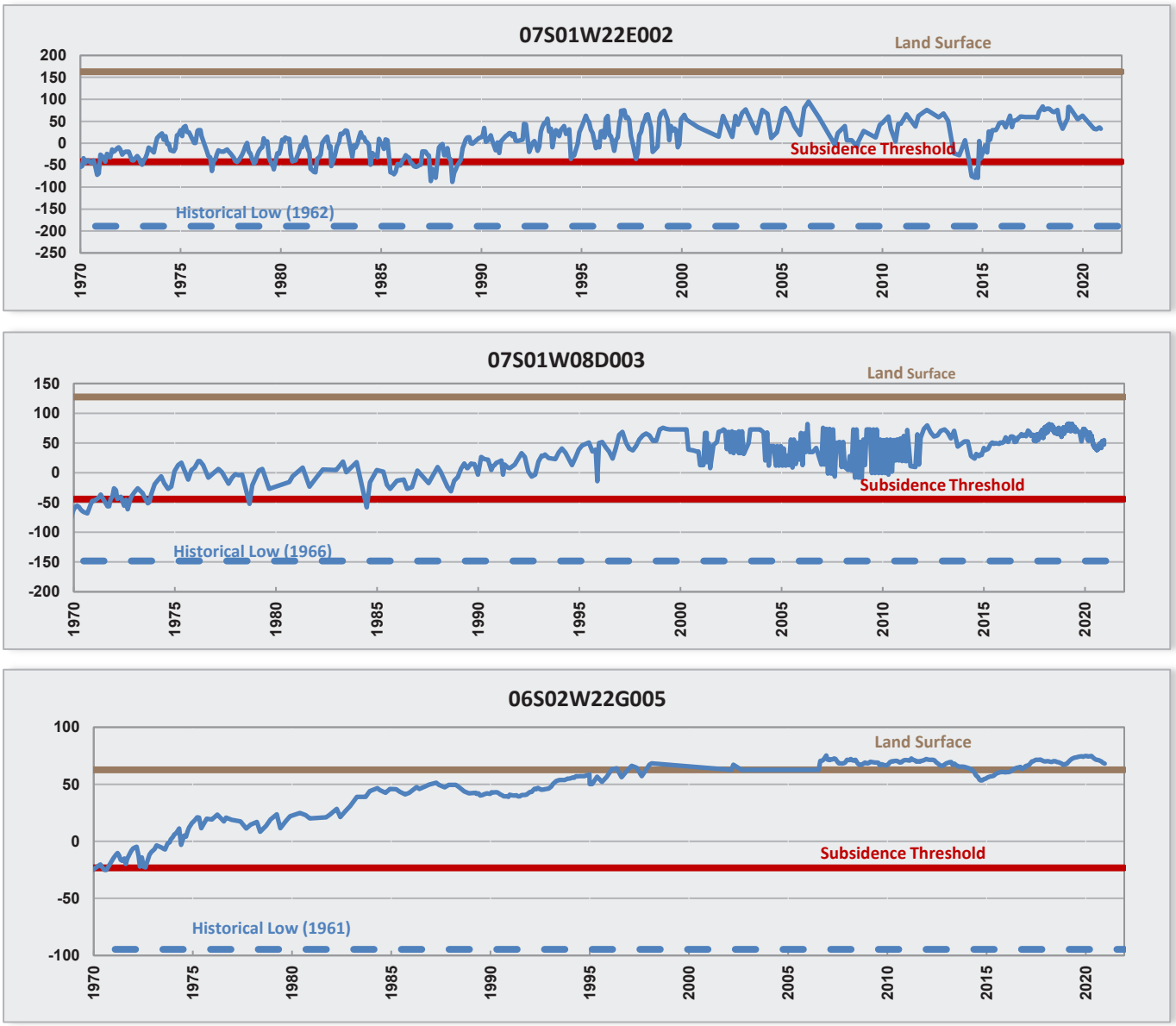
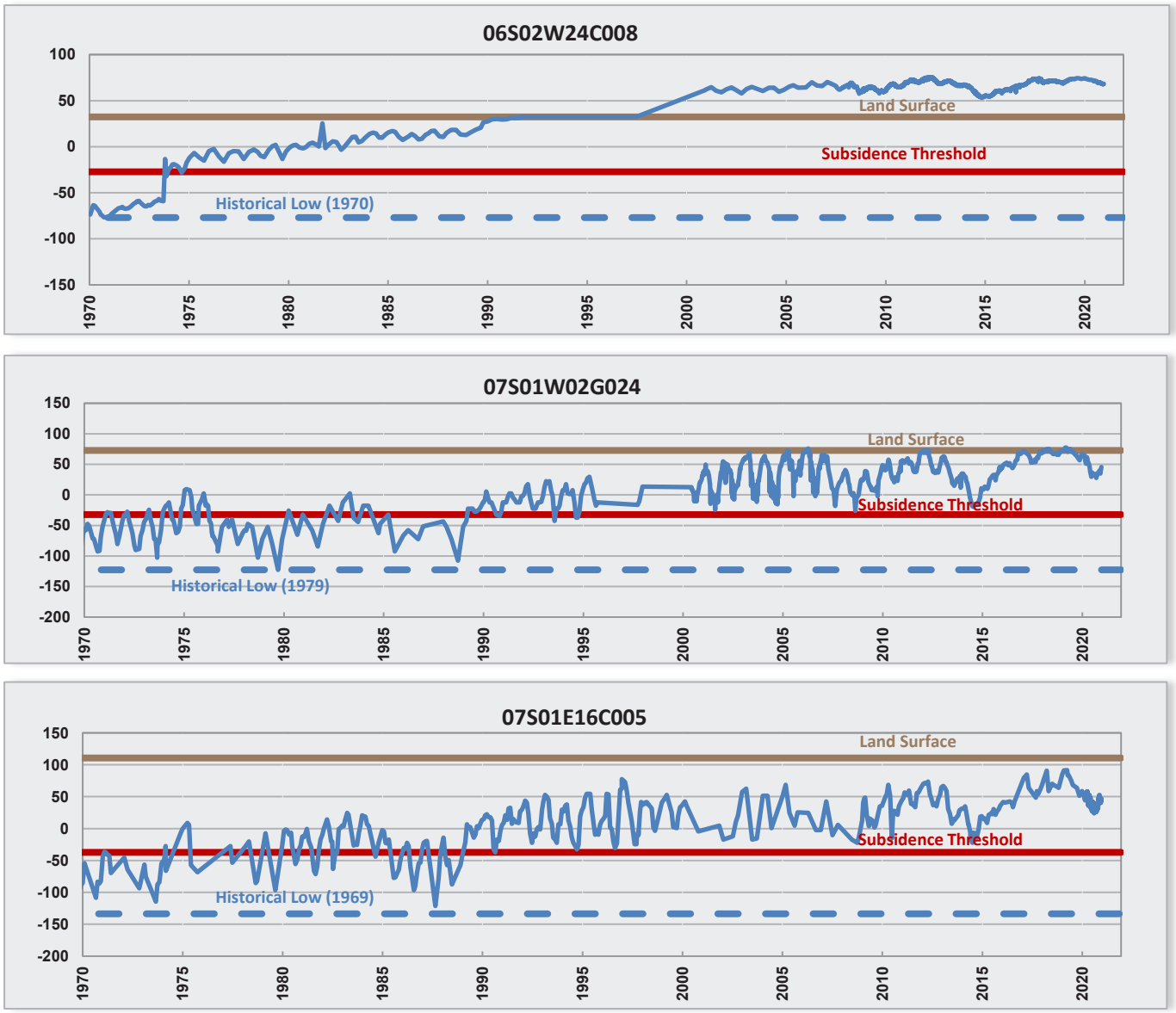


Figure 20. Groundwater Levels at Santa Clara Plain Subsidence Index Wells (feet, NAVD88 continued)



Notes on hydrograph for 07S01E16C005: In May 2021, the PRESS subsidence index well #10 (07S01E16C006) was replaced with 07S01E16C005 for all subsequent subsidence monitoring and analysis. The replacement well (07S01E16C005) is located at the same well field but has several advantages over the existing 07S01E16C006 well, including better access, increased (daily) monitoring frequency, and accessibility with telemetry. Additional details about the rationale for replacing the well is documented in the memorandum by Liu et al. (2021) (Appendix A).

Land Subsidence Outcome Measure

As shown in Figures 19 and 20 and described in this chapter, Valley Water's land subsidence outcome measure was met in 2020.

OM 2.1.1.d.

100% of subsidence index wells with groundwater levels above subsidence thresholds.
This outcome measure was met. Groundwater levels were above subsidence thresholds at all ten Santa Clara Plain subsidence index wells.

CHAPTER 5

Groundwater Quality

CHAPTER 5 – GROUNDWATER QUALITY

In 2020, Valley Water collected groundwater samples from 113 wells and analyzed the water quality. This included 84 dedicated monitoring wells and domestic wells that are sampled each year, 4 domestic wells tested through a voluntary sampling program, and 25 monitoring wells near recycled water irrigation sites. Valley Water also analyzed groundwater quality data from 252 public water supply wells.[1] Summary results for water supply wells are provided in the Annual Groundwater Quality Summary Report (Appendix B). Summary tables of analyzed parameters with the median and range for each subbasin and aquifer zone[2] for all regional wells sampled are provided in Appendix C. These tables do not include results from wells near recycled water irrigation sites, which are presented in Appendix D.

Water quality testing indicates that groundwater in the Santa Clara and Llagas Subbasins meets drinking water standards in most wells for all parameters tested. The exception is nitrate, which was found above the regulatory standard in 22% of South County water supply wells (primarily domestic wells) due to historic and on-going sources. The Salt and Nutrient Management Plan[3] implementation supports reduced nitrate loading and exposure. Valley Water also offers eligible domestic well owners free water testing for nitrate.

Valley Water did not conduct recharge monitoring in 2020 due to the COVID-19 pandemic. Recharge monitoring planned for 2020 will be rescheduled for 2021.

Valley Water monitors groundwater quality at wells near recycled water irrigation sites. In 2020, Valley Water analyzed data from 9 monitoring wells in the Santa Clara Plain and 19 wells and 2 turnouts in the Llagas Subbasin. In the Santa Clara Plain, there are mixed concentration trends for basic water quality parameters. Groundwater in the Llagas Subbasin generally shows stable or decreasing concentration trends for key recycled water indicators. Based on an analysis of wastewater indicators, concentration trends and geochemistry, it appears that some changes in both subbasins may be due to irrigation with recycled water. Related results are summarized in Section 5.5 and more detailed results and data tables are provided in Appendix D.

Valley Water continues to track emerging technical and regulatory issues related to per- and polyfluoroalkyl substances (PFAS), a group of widely used but unregulated chemicals with known and suspected adverse health effects. Valley Water conducts ongoing PFAS sampling near recycled water irrigation sites in the Llagas Subbasin. In 2020, Valley Water expanded efforts to determine the extent and occurrence of PFAS in groundwater throughout Santa Clara County, including regional sampling.[4] Results indicate that PFAS are detected in some wells, but are not widely present above current State health-advisory levels. However, ten water retailer wells were voluntarily removed from service due to

[1] Data for public water systems is available from the State Water Resources Control Board Division of Drinking Water website.
[2] Public water supply wells were assumed to represent the principal aquifer is no construction information was available, as these are typically deep wells.
[3] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater/groundwater-studies
[4] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater/groundwater-quality

PFAS. Valley Water is working closely with the water retailer and regulatory agencies to evaluate potential sources and further action needed to protect groundwater quality.

Valley Water continues to coordinate with local, state, and federal agencies managing cleanup of groundwater contamination sites by tracking progress on high-priority sites and issuing recommendations for effective remediation. Valley Water will continue to track water quality changes and work with stakeholders to identify ways to protect groundwater quality from the threat of contamination.

5.1 Regional Groundwater Quality

Valley Water analyzed groundwater quality at 85 locations that are sampled annually, including 65 monitoring wells and 20 domestic and agricultural wells (Figure 21). Most samples were analyzed for almost 50 water quality parameters including major and minor ions, nutrients, and trace metals. Water from 16 shallow monitoring wells near the San Francisco Bay, used for sea water intrusion monitoring, were analyzed for ions and metals only. The regional groundwater quality evaluation also incorporates data from four wells with known construction sampled through Valley Water's voluntary domestic well sampling program and data from 252 public water supply wells sampled by public water systems and reported to the State Water Resources Control Board Division of Drinking Water (DDW).

To evaluate regional conditions, water quality results are compared to state and federal water quality standards and to prior year results. A summary table of sampled parameters showing the median and range for each subbasin and aquifer zone[5] is provided in Appendix C. Results indicate that groundwater in the Santa Clara and Llagas subbasins is generally of high quality. Water quality indicators, ions, and trace elements were within the normal range expected in groundwater, except for nitrate. Elevated nitrate concentrations are primarily an issue in South County due to historic and ongoing sources including synthetic fertilizer, septic systems, and animal enclosures.

Median concentrations for nitrate and TDS were compared to historical median concentrations and plotted over time (Figure 22). The 2020 median nitrate as nitrogen (N) concentrations of 1.7 and 2.9 mg/L in the Santa Clara Plain shallow and principal aquifers, respectively, remain relatively unchanged when compared to 2019. The 2020 median nitrate concentrations in the Llagas Subbasin shallow and principal aquifers were 10 and 5.3 mg/L, respectively, a slight increase when compared to the prior year.

Compared to 2019, the 2020 principal aquifer median for TDS increased marginally in the Santa Clara Plain and remained relatively stable in the Llagas Subbasin. Overall, median nitrate concentrations in the principal aquifers of the Santa Clara and Llagas subbasins remained stable. Fluctuations in annual sample medians are expected due to the number of wells tested, annual recharge, pumping, and rainfall.

Eighteen VOCs, which include disinfection byproducts, were detected in groundwater in 2020, as summarized and listed by subbasin in Table C-4 (Appendix C). However, none were confirmed to be present above the Maximum Contaminant Level (MCL) and maximum concentrations were typically

[5] Public water supply wells were assumed to represent the principal aquifer if no construction information was available, as these are typically deep wells.

well below the MCL. VOCs occur primarily from industrial use of solvents and from leaking underground fuel tanks. No pesticide compounds were detected above the MCL in 2020.

Figure 21. CY 2020 Groundwater Quality Monitoring Wells

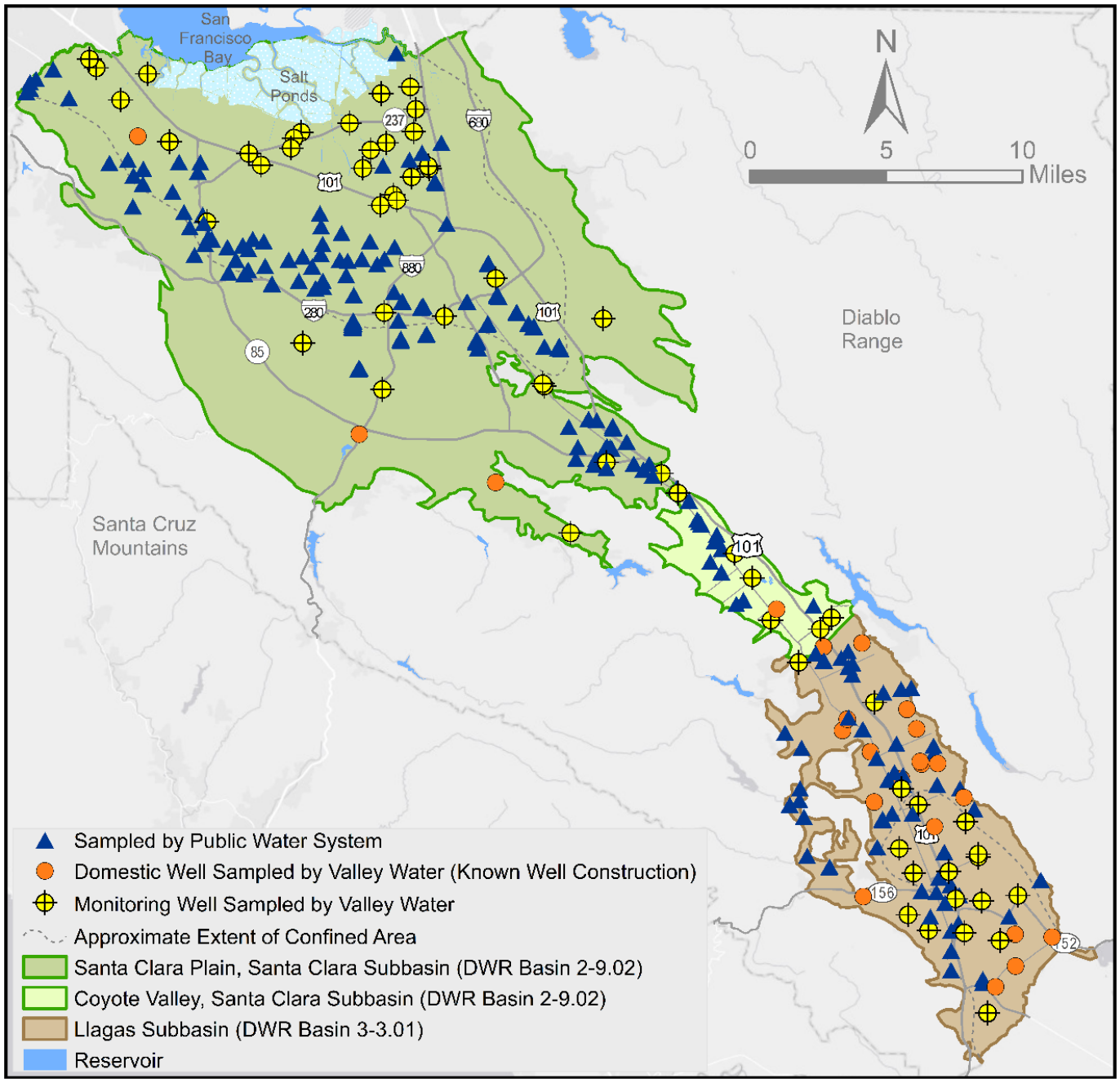
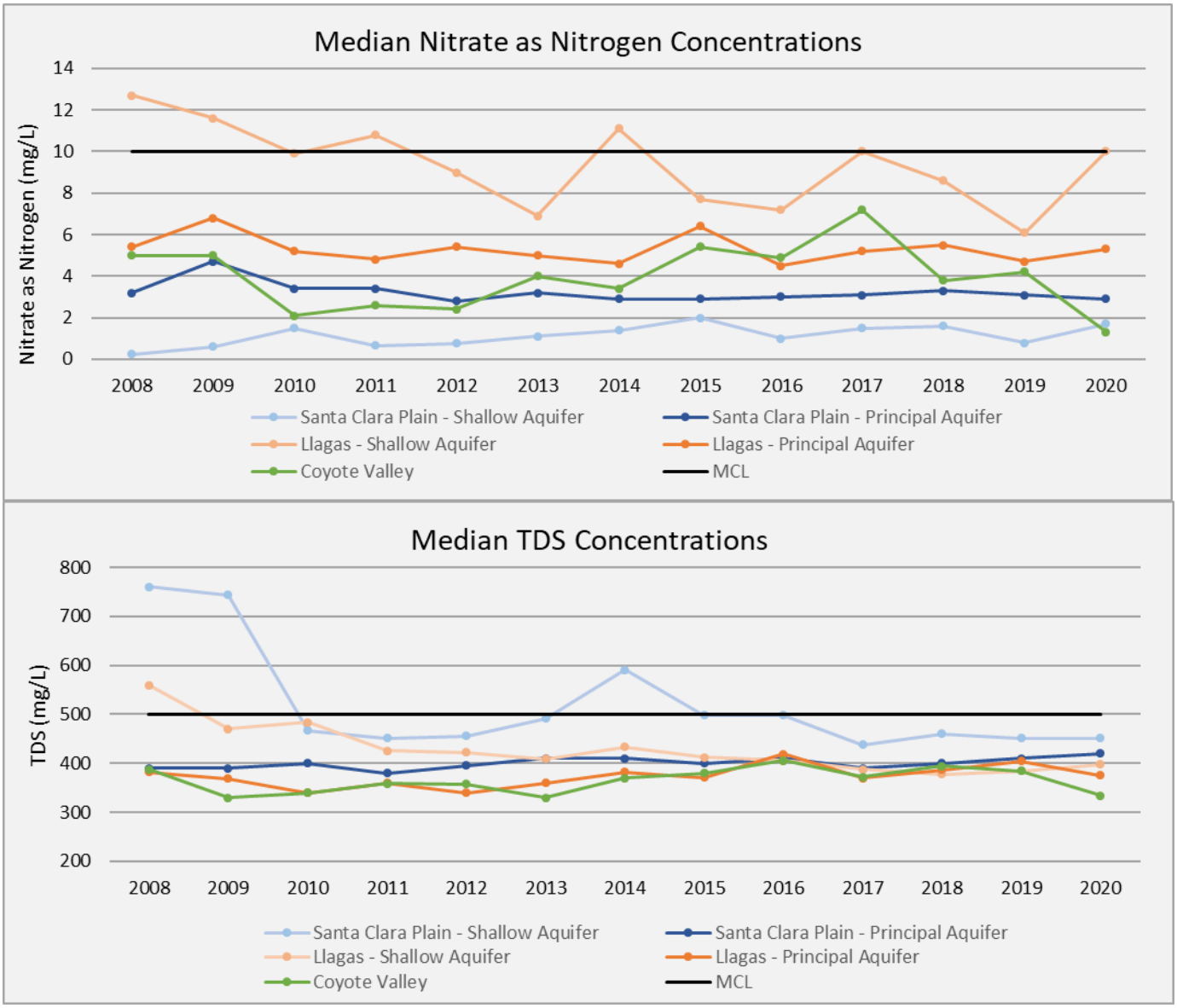


Figure 22. Median Nitrate and TDS by Subbasin and Aquifer Zone (mg/L)



Notes:

1. The shallow and principal aquifer zones are represented by wells primarily drawing water from depths less than and greater than 150 feet below ground surface, respectively.
2. Nitrate as Nitrogen has a health-based MCL of 10 mg/L. TDS has an aesthetic-based MCL, which ranges from 500 to 1,000 mg/L (recommended and upper limit, respectively).
3. Information shown is from monitoring wells, public water supply wells, and domestic wells for which construction information is available. The set of wells sampled each year varies.
4. Median TDS in the Santa Clara Plain shallow aquifer excludes certain wells near San Francisco Bay within the region influenced by seawater interaction.

Comparison to Drinking Water Standards

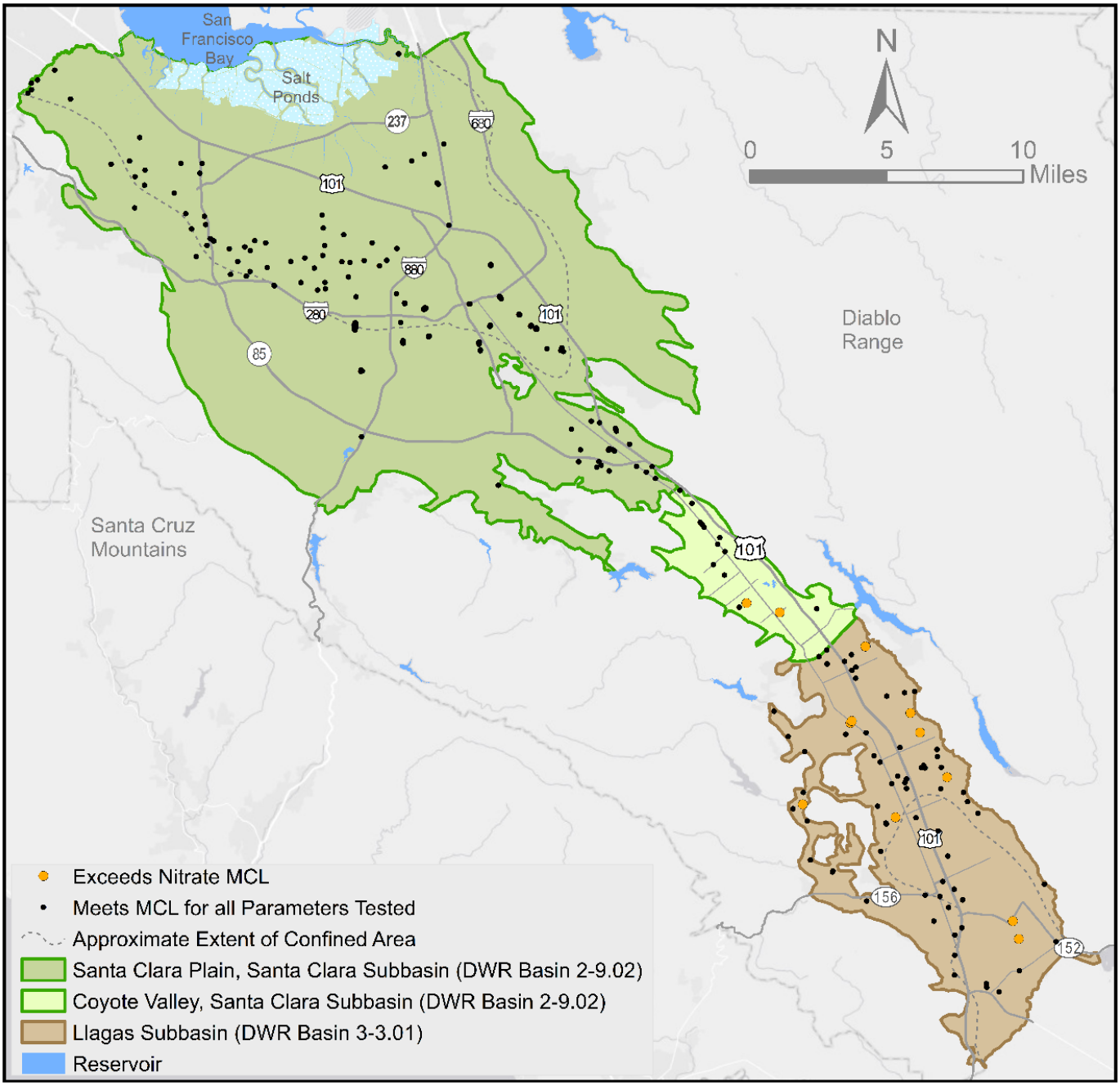
Except for nitrate, all water supply wells tested, including public and private domestic wells, met all MCLs. Figure 23 shows the locations of water supply wells tested in 2020 with an MCL exceedance.[6] For public water supply wells, 98% met all MCLs, while 65% of all domestic wells met MCLs for the parameters tested (typically fewer parameters compared to public wells).

In 2020, nitrate was below its primary MCL of 10 mg/L in 96% of all water supply wells countywide and 87% of South County water supply wells. In South County, 8% of public water supply wells and 35% of domestic wells tested have at least one result above the MCL. Most detections were from private domestic wells that are not regulated by the state, while four wells were part of public water systems, which must comply with all drinking water standards. Based on communication with private well owners participating in Valley Water sampling programs, many use bottled water for drinking and cooking, or reverse osmosis treatment to reduce nitrate exposure.

While not used as a source of drinking water, some monitoring wells sampled are screened in the principal aquifer zone. Two deep monitoring wells in the Llagas Subbasin had a nitrate detection above the MCL. Seven shallow aquifer zone monitoring wells in the Llagas Subbasin also had nitrate detections above the MCL. Shallow groundwater quality is important, even though it is generally not used as a source of drinking water, because it is a potential water supply source and because shallow groundwater recharges the principal aquifer in recharge areas.

[6] For data obtained from the DDW website, any result reported above an MCL is considered an exceedance for the purposes of this report. Based on DDW regulations and follow-up sampling, a single detection above an MCL may not constitute a violation of a drinking water standard.

Figure 23. CY 2020 MCL Exceedances at Water Supply Wells



Unregulated Contaminant Monitoring

The U.S. Environmental Protection Agency (EPA) has developed a systematic process for evaluating whether individual chemicals should be regulated to ensure that drinking water poses no significant risk to the public. Every five years, the EPA publishes a list of unregulated compounds to be analyzed in large public water systems through the Unregulated Contaminant Monitoring Rule (UCMR). The EPA uses the UCMR to collect data on contaminants that are suspected to be present in drinking water and do not have health-based standards set under the Safe Drinking Water Act. The EPA has completed three rounds of UCMR: UCMR 1 with monitoring between 2001 and 2003, UCMR 2 with monitoring between 2008 and 2010, and UCMR 3 with monitoring between 2013 and 2015. UCMR 3 results for groundwater in Santa Clara County (sampled by water retailers) were summarized in Valley Water's Annual Groundwater Report for 2016. UCMR 4 monitoring occurred between 2018 and 2020 and included a total of 30 contaminants including cyanotoxins, metals, pesticides and related byproducts, disinfection byproducts, alcohols, and semi-volatile organic chemicals. UCMR 4 sampling results will be evaluated and presented when available through the EPA.

Comparison to Agricultural Objectives

Agriculture in Santa Clara County is largely limited to the Coyote Valley and Llagas Subbasin. South County groundwater quality was evaluated against agricultural water quality objectives from the applicable Regional Water Quality Control Board Basin Plans[7] to assess its suitability. Because Valley Water has limited access to agricultural wells, water supply well data was used in this evaluation. One hundred percent of all South County water supply wells met Basin Plan agricultural objectives.

5.2 Groundwater Quality Trends

To assess changes in water quality over time, chloride, nitrate, and TDS concentrations were evaluated using a variety of techniques over a 15-year period (2006 – 2020) for all groundwater management areas and aquifer zones. Statistical trend tests applied to individual wells required at least five sample results. Trend analysis results show that most wells have stable or decreasing chloride, nitrate, and TDS concentration trends, although some upward trends are observed. A total of 81%, 93%, and 91% of all wells have stable or decreasing concentrations of chloride, nitrate, and TDS, respectively (Table 7).

Figures 24 through 26 and Table 7 show that most of the shallow wells in the Santa Clara Plain with increasing chloride concentrations are in the area affected by seawater intrusion. Most data for Coyote Valley suggest groundwater nitrate levels are unchanging or decreasing during the period examined, with only four wells exhibiting upward trends. In the Llagas subbasin, stable chloride concentrations were found in 60% of wells tested in the shallow aquifer zone. The remainder of wells showed evidence of upward trending concentrations over the period examined, a higher percentage than all other

[7] Groundwater in the Coyote Valley is compared to the "limit" field in Table 3-6 of the San Francisco Bay Basin Water Quality Control Basin Plan (May 2017). Groundwater in the Llagas Subbasin is compared to the upper range of the "increasing problems" range in Table 3-1 and Table 3-2 (irrigation supply) of the Water Quality Control Plan for the Central Coast Basin (June 2019).

groundwater management areas. Disposal of consumed water via septic systems could explain the greater incidences of upward chloride trends; however further evaluation is warranted.

Table 7. Chloride, Nitrate, and TDS Concentration Trends (2006 – 2020)

Groundwater Management Area	Parameter	Number of Wells Evaluated	Percent of Wells with Stable Concentrations	Percent of Wells with Decreasing Concentrations	Percent of Wells with Increasing Concentrations
Santa Clara Plain Shallow Aquifer	Chloride	31	65%	16%	19%
	Nitrate (as N)	24	75%	25%	0%
	TDS	30	76%	17%	7%
Santa Clara Plain Principal Aquifer	Chloride	123	87%	0%	13%
	Nitrate (as N)	228	64%	29%	7%
	TDS	121	91%	2%	7%
Coyote Valley	Chloride	15	93%	0%	7%
	Nitrate (as N)	35	69%	20%	11%
	TDS	16	94%	0%	6%
Llagas Subbasin Shallow Aquifer	Chloride	20	60%	0%	40%
	Nitrate (as N)	24	96%	0%	4%
	TDS	20	85%	0%	14%
Llagas Subbasin Principal Aquifer	Chloride	4	70%	2%	28%
	Nitrate (as N)	111	69%	25%	6%
	TDS	45	87%	2%	11%
All Groundwater Management Areas	Chloride	235	78%	3%	19%
	Nitrate (as N)	422	67%	26%	7%
	TDS	232	87%	4%	9%

Figure 24. Chloride Concentration Trends (2006 - 2020)

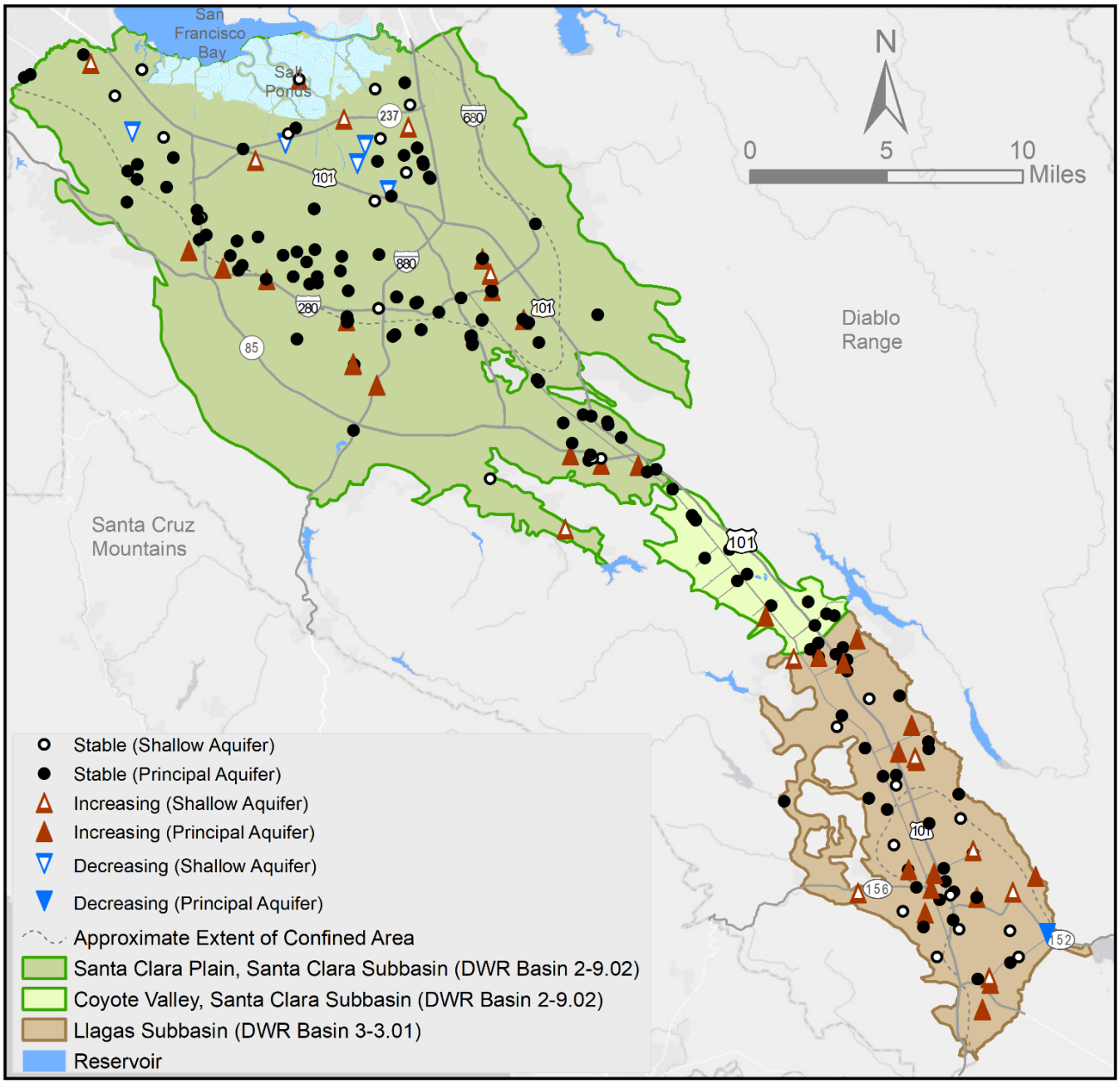


Figure 25. Nitrate Concentration Trends (2006 - 2020)

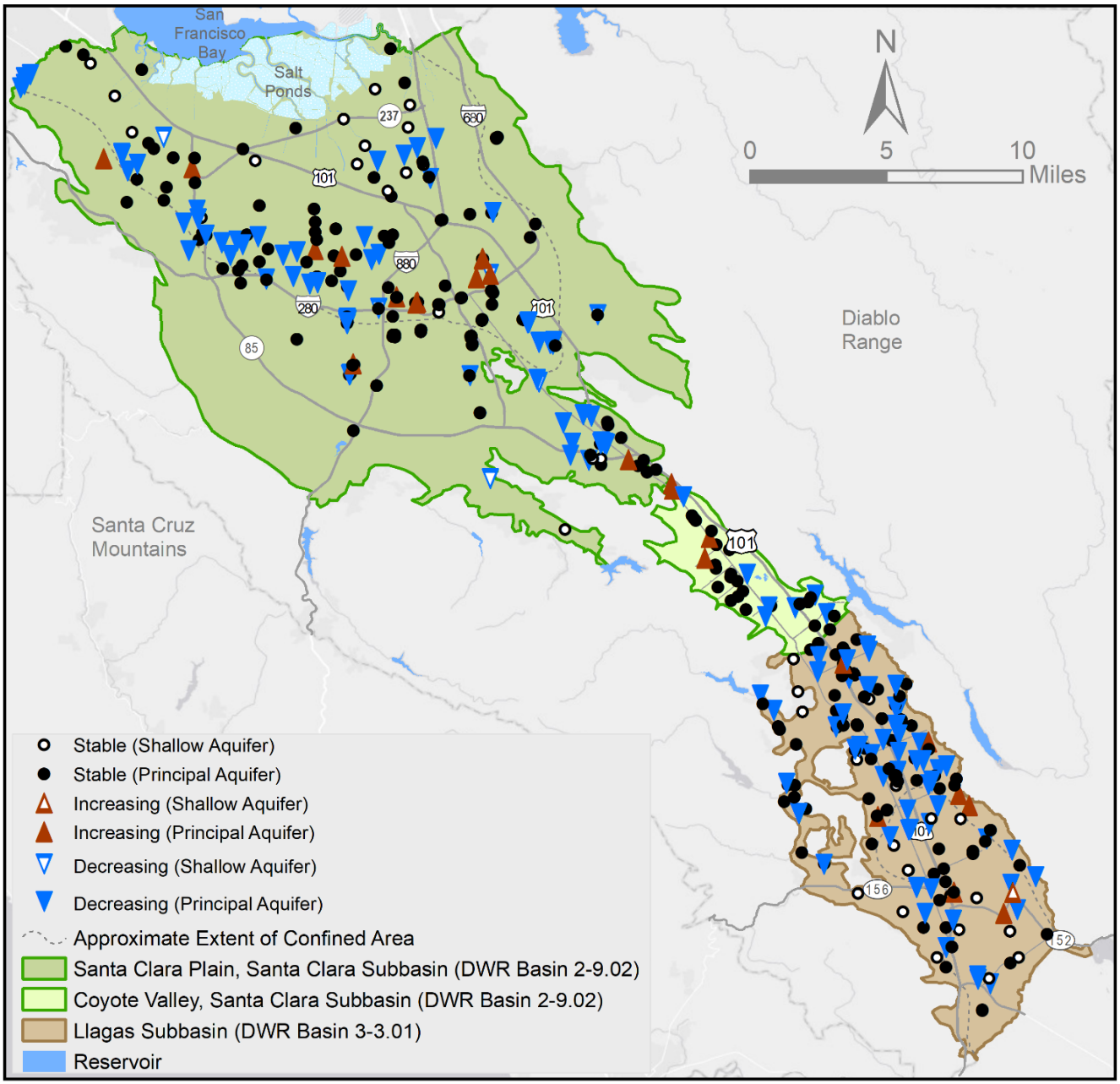
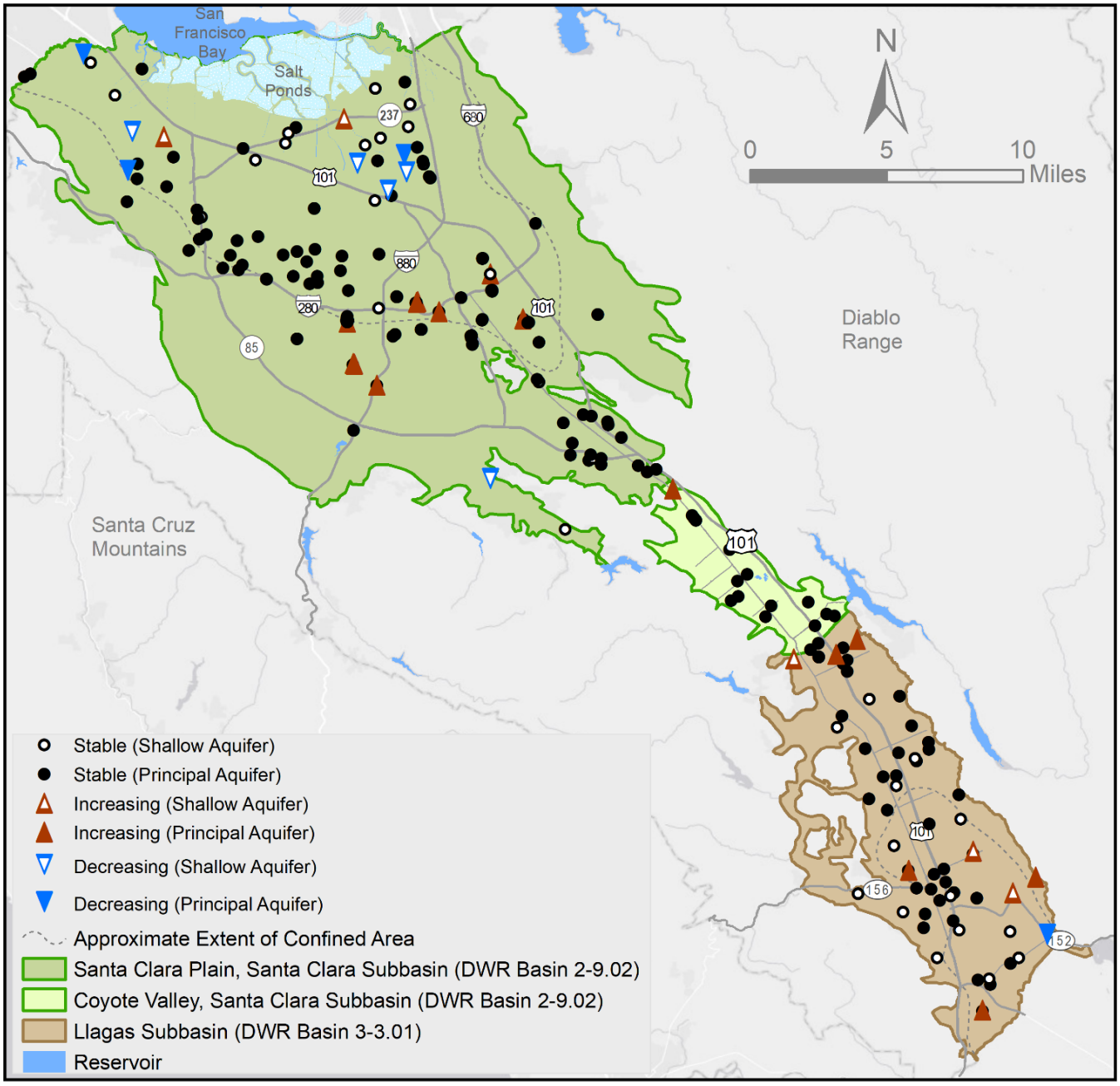


Figure 26. Total Dissolved Solids (TDS) Concentration Trends (2006 - 2020)



Step Trend Analyses

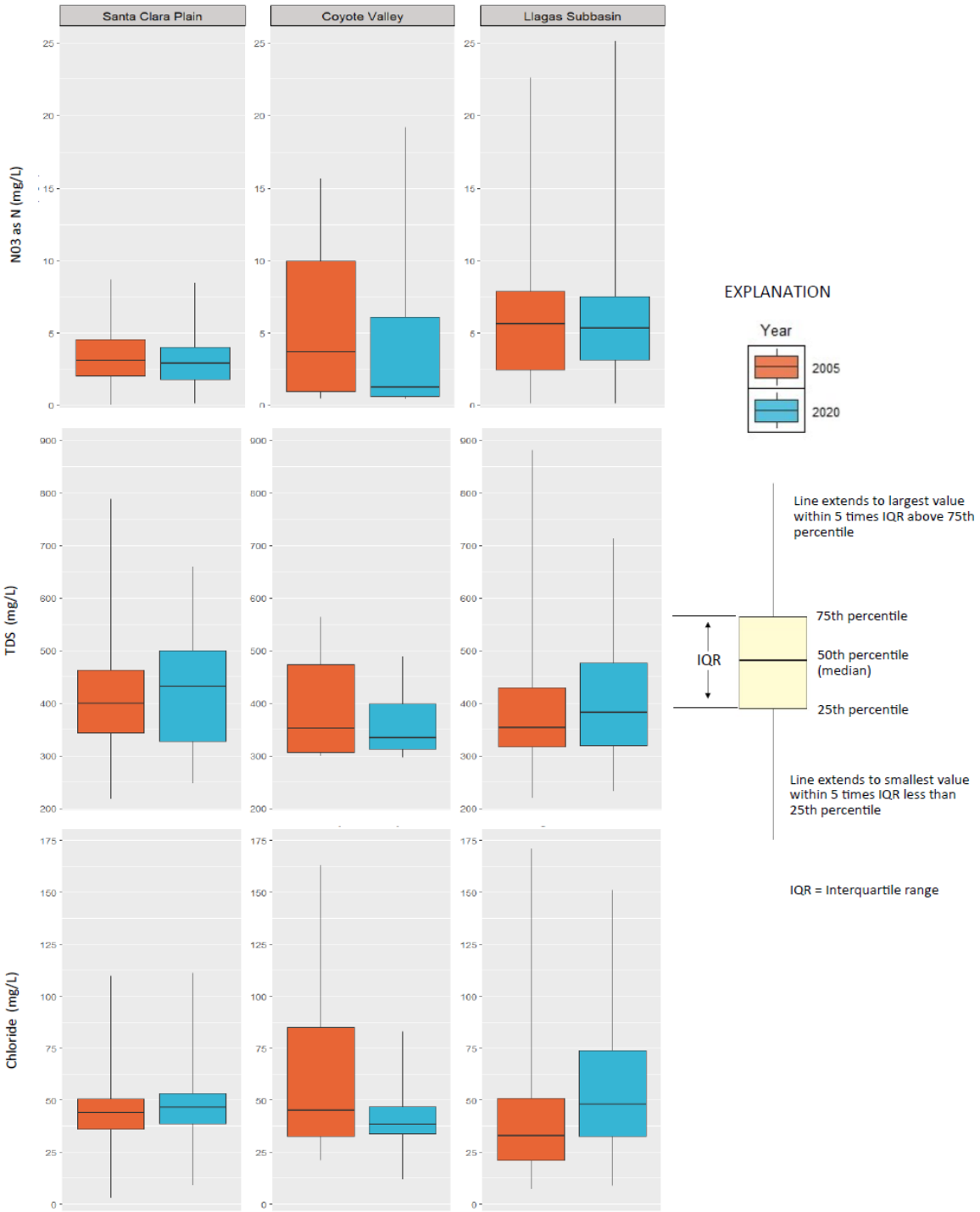
Valley Water conducted a five, ten, and fifteen-year statistical step trend analysis of nitrate, TDS, and chloride concentrations by groundwater management area for all areas. Differences between data groups are suggestive of changing concentrations within the designated timeframe. The results (Table 8) show that there is a decrease in nitrate (approximately 0.5 mg/L) in the Santa Clara Plain from 10 years prior (2010) and an increase in chloride (approximately 15 mg/L) in the Llagas compared to 15 years prior (2005). The 15-year step trend data sets for nitrate, TDS, and chloride by groundwater management area are represented below using boxplots (Figure 27).

Table 8. Total Dissolved Solids, Nitrate, and Chloride Step Trend Outcome in Principal Aquifers

	5-Year Step Trend	10-Year Step Trend	15-Year Step Trend
Total Dissolved Solids (TDS, mg/L)			
Santa Clara Plain	No Change	No Change	No Change
Coyote Valley	No Change	No Change	No Change
Llagas Subbasin	No Change	No Change	No Change
Nitrate (as Nitrogen, mg/L)			
Santa Clara Plain	No Change	Decrease (~0.5 mg/L)	No Change
Coyote Valley	No Change	No Change	No Change
Llagas Subbasin	No Change	No Change	No Change
Chloride (mg/L)			
Santa Clara Plain	No Change	No Change	No Change
Coyote Valley	No Change	No Change	No Change
Llagas Subbasin	No Change	No Change	Increase (~15 mg/L)

Note: The median 2019 concentration for each groundwater management area was compared to that of 5 years ago (2015), 10 years ago (2010), and 15 years ago (2005) to determine if there is any statistically significant difference using the Mann-Whitney test at the 95% confidence level.

Figure 27. Boxplots Representing Fifteen-Year Step Trend Groups by Groundwater Management Area and Trend Parameter



Notes:

1. There is no significant difference between paired-groups (Mann-Whitney test, 95% confidence).
2. Some outliers are present but not all are shown within plot y-axis scale.

Seawater Intrusion

Seawater intrusion (SWI) refers to the temporary or permanent flux of seawater into coastal freshwater aquifers. Seawater intrusion is a groundwater management concern because it can degrade groundwater quality and, if severe enough, result in undesirable conditions that may include limiting groundwater as a water supply for municipal and industrial uses, agriculture, and domestic uses, or degrading groundwater dependent ecosystems or infrastructure.

Seawater intrusion in the shallow aquifer zone of the Santa Clara Plain is largely attributed to incursion of water from San Francisco Bay into the tidal reaches of creeks and subsequent transport to shallow groundwater through streambed percolation. This seawater incursion was exacerbated by previous land subsidence, which decreased the elevation of the land surface adjacent to San Francisco Bay, causing further inland movement along tidal creeks. The degree of SWI in the shallow aquifer zone is assessed by the chloride content in monitoring wells located in the baylands area adjacent to southern San Francisco Bay. Valley Water uses a chloride concentration of 100 mg/L to indicate the first sign of influence from seawater (Figure 28). This is a conservative threshold, since the aesthetic based MCL for chloride is 250 mg/L.

Wells with chloride over 100 mg/L are located in a narrow band adjacent to the former salt evaporation ponds, except in the areas adjacent to Guadalupe River and Coyote Creek affected due to tidal incursion in these channels (Figure 28). High chloride concentrations up to several thousand parts per million are observed near the levee system that defines the former salt evaporation ponds and are indicative of the classic case of SWI (via direct, subsurface flow). However, the leakance of seawater beneath tidal stream flow has a larger influence on the spatial extent of the 100 mg/L chloride isocontour. Most shallow wells in this area have stable or decreasing long-term concentration trends for chloride, demonstrating that the seawater intrusion front appears to be stable or retreating due to improved groundwater conditions.

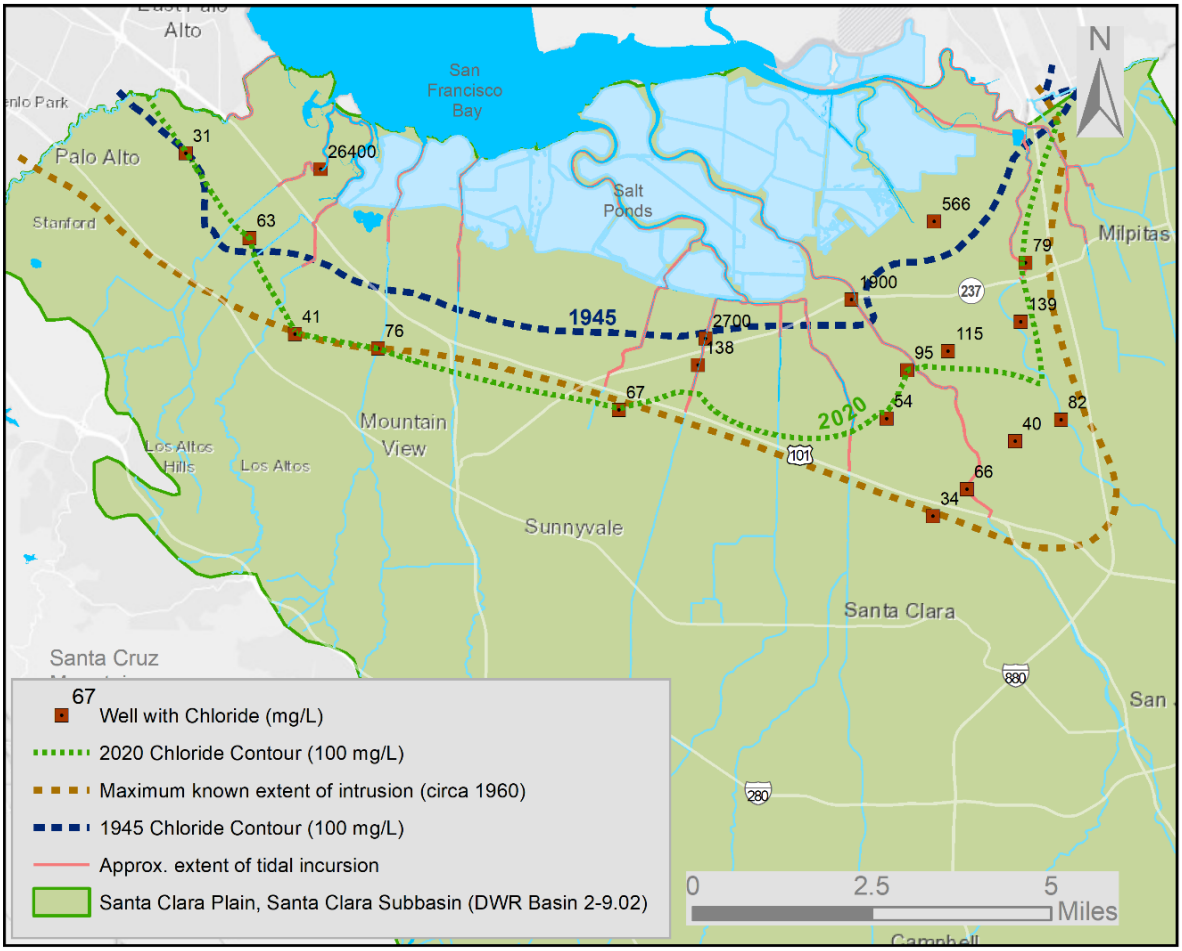
Few wells in the principal aquifer zone have ever had highly elevated TDS or chloride concentrations. Historically, the classic case of seawater intrusion has affected only a small portion of the shallow aquifer zone beneath and immediately adjacent to the Bay and salt ponds, and thus is a minimal threat to groundwater supply because the principal aquifer zone is protected by the regional aquitard and chloride concentrations in the principal aquifer are relatively low beneath much of the 100 mg/L chloride isocontour in the shallow aquifer zone. The relatively minor intrusion into the deeper, principal aquifer zone is believed to be due to some classic SWI and inter-aquifer transfer through improperly destroyed wells when the vertical hydraulic gradient is downward[8]. At isolated locations in Palo Alto and southeast San Jose, the source of elevated TDS and chloride in deeper wells there has been attributed to connate water (trapped salt water from the geologic past), rather than recent seawater intrusion.

Presently, the monitoring network in the Baylands area has limited coverage of the principal aquifer zone. Recommendations for additional monitoring for SWI and further discussion on SWI mechanisms affecting the 100 mg/L chloride isocontour across the Santa Clara Subbasin will be outlined in the 2021 Groundwater Management Plan.

[8] Vertical gradients in the Baylands area where seawater interaction occurs have been upward for the last 20 years (approximately).

There are no seawater bodies near the Llagas Subbasin. Therefore, no seawater intrusion has been observed and the subbasin is not vulnerable to seawater intrusion.

Figure 28. Groundwater and Seawater Interaction in the Santa Clara Plain Shallow Aquifer



5.3 Domestic Well Water Quality

Valley Water offers free, basic water quality testing to domestic well owners within its groundwater benefit zones through the Domestic Well Testing (DWT) program. In 2020, 1 domestic well in North County and 22 domestic wells in South County were tested through the DWT and annual groundwater sampling programs. Parameters tested include nitrate as nitrogen, fluoride, sulfate, TDS, hardness, bromide, orthophosphate, and bacteria. The number and locations of wells sampled under the DWT program vary by year based on voluntary participation. North County testing included no new wells and no repeat wells, while South County included one new well and three repeat wells. Data from Valley Water's DWT and annual groundwater sampling programs are summarized in this section. As a result of the coronavirus pandemic, on March 13, 2020, the DWT program was placed on hold; therefore, domestic well water quality data is limited for 2020.

Domestic well testing helps improve Valley Water's understanding of the occurrence of common contaminants and helps private well owners understand their water quality, so they can make informed decisions. Although water quality in domestic wells is not regulated by the state, the comparison to state drinking water standards provides context for interpreting results. When testing domestic wells, Valley Water notifies well owners when any contaminants are present above drinking water standards or when bacteria is present and offers information on additional actions the well owner may wish to take. Table 9 summarizes North County and South County results, including median concentrations and percent of wells with concentrations above drinking water standards.

Nitrate

Of the wells tested, nitrate was not detected above the MCL in the one North County domestic well but was detected over the MCL in eight South County wells. Nitrate results are shown in Figure 29. The median nitrate concentrations in domestic wells in South County was 7.3 mg/L. The 2020 regional median nitrate concentrations for the principal aquifer in the Santa Clara Plain, Coyote Valley, and Llagas Subbasin (including public water supply wells which are typically deeper) were 2.9, 1.3, and 5.3 mg/L, respectively.

The continued presence of nitrate above the MCL in many domestic wells in Santa Clara County and many areas of California highlights the need for ongoing efforts by regulatory and land use agencies, agricultural operators, and groundwater management agencies like Valley Water to address elevated nitrate in groundwater. To reduce well owners' exposure to nitrate, Valley Water began implementation of a multi-year rebate program for nitrate treatment systems in the fall of 2013, funded by the Safe, Clean Water and Natural Flood Protection Program (Measure B, a countywide special parcel tax)[9]. In 2020, two nitrate treatment system rebates were issued. This effort complements outreach and other efforts to reduce nitrate loading in coordination with the Central Coast Water Board and other basin stakeholders.

TDS

TDS does not have a primary MCL or public health goal, but instead has a secondary MCL, which is based on aesthetic concerns. The secondary MCL for TDS in drinking water is 500 mg/L (recommended), 1,000 mg/L (upper), and 1,500 mg/L (short-term). Of the wells tested, TDS was not detected above the recommended secondary MCL in the one North County domestic well but was detected above the recommended secondary MCL in six South County domestic wells. No domestic wells exceeded the upper secondary MCL or the short-term secondary MCL. The median TDS concentrations in domestic wells in North and South County were 398 mg/L and 400 mg/L, respectively. The 2020 regional median TDS concentrations for the principal aquifer in the Santa Clara Plain, Coyote Valley, and Llagas Subbasin were 420 mg/L, 334 mg/L, and 375 mg/L, respectively.

Bacteria

Testing for bacteria included total coliform and Escherichia coli (E. coli), a type of coliform bacteria indicative of fecal contamination. Coliform bacteria are a large family of bacteria naturally present in humans, animals, and the environment and do not normally cause illness, but they should not be

[9] The nitrate rebate program sunset in June 2021.

present in drinking water. Total coliform bacteria were detected in 17% of the domestic wells tested, a lower percentage than in 2019 (29%), while E. coli was not detected in any of the domestic wells.

Figure 29. Nitrate Results for Domestic Wells Tested in 2020

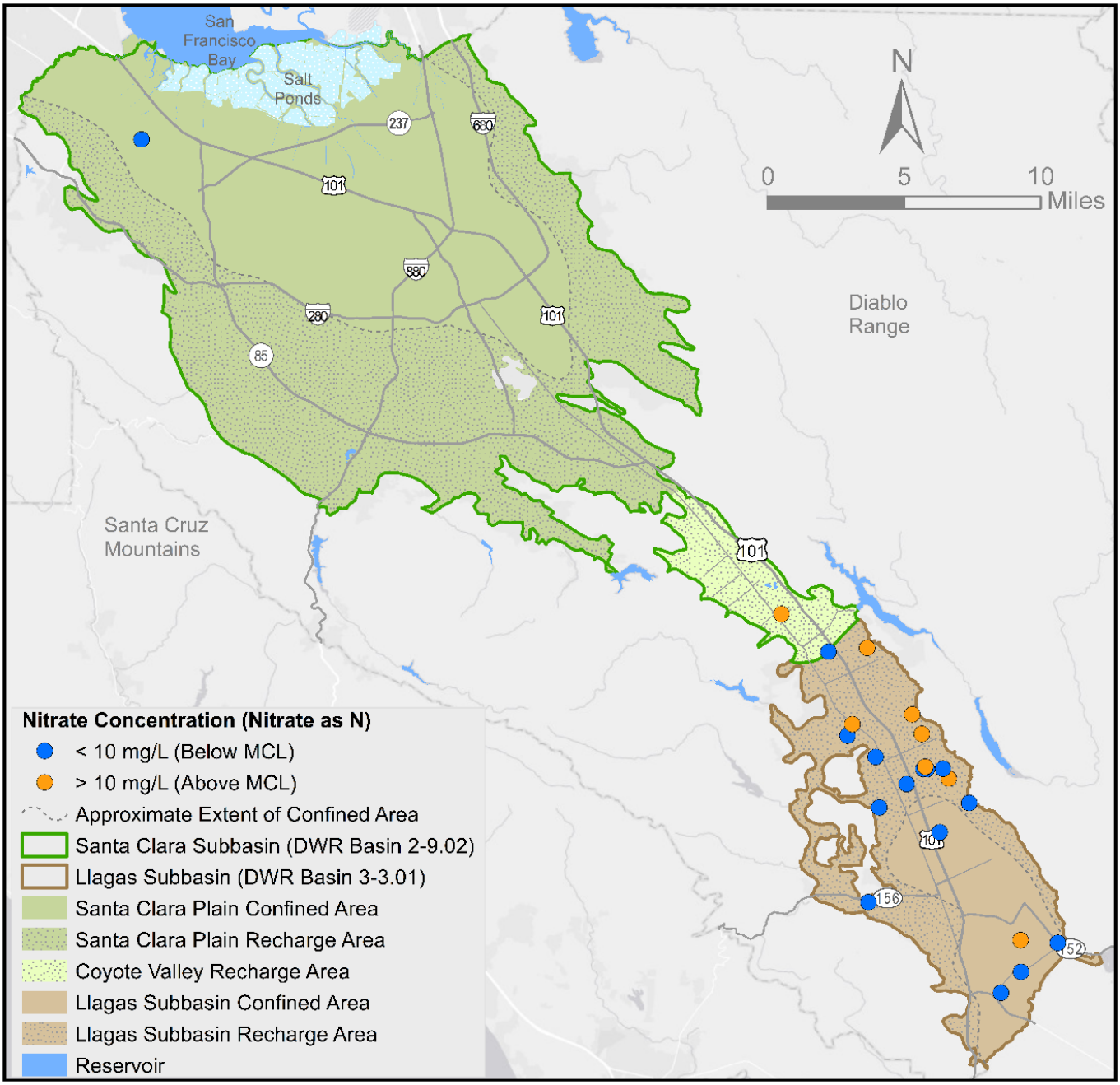


Table 9. 2020 Domestic Well Testing Results

Parameter and Units	MCL[1]	Zone W-2 North County		Zone W-5 South County	
		Median	Wells above MCL[1] (%)	Median	Wells above MCL[1] (%)
Nitrate as N (mg/L)	10 (P)	<0.1	0%	7.3	36%
Fluoride (mg/L)	2 (P)	<0.1	0%	0.10	0%
Sulfate (mg/L)	250 (S)	39	0%	43	0%
Total Dissolved Solids (mg/L)	500 (S)	398	0%	400	27%
Hardness (mg/L as CaCO3)	--	262	--	293	--
Bromide (mg/L)	--	0.18	--	0.25	--
Orthophosphate (mg/L as PO4)	--	0.3	--	0.13	--
		Wells with Bacteria Present (No.)	Wells with Bacteria Present (%)	Wells with Bacteria Present (No.)	Wells with Bacteria Present (%)
Total Coliform Bacteria	--[2]	1	100%	3	14%
E. Coli Bacteria	--[2]	0	0%	0	0%

Notes:

1. Maximum contaminant levels are established by the DDW for public water systems. (P) indicates the parameter has a health-based Primary MCL and (S) indicates a Secondary, aesthetic-based MCL. Hardness does not have a primary or secondary MCL but water with hardness above 180 mg/L is classified as very hard. Water quality in domestic wells is not regulated by the state.
2. Bacteria are measured as present or absent. Public water systems are required to ensure that fewer than 5% of samples have total coliform present and that no samples have E. Coli present.

5.4 Recharge Water Quality

Valley Water monitors water quality at selected groundwater recharge facilities in the Santa Clara and Llagas Subbasins to characterize recharge water quality and assess the need for changes to groundwater monitoring and/or recharge programs to ensure adequate groundwater protection.[10] Recharge facilities (percolation ponds and managed reaches of creeks) receive a combination of local runoff and imported water. The ratio of local runoff to imported water varies throughout the year and between years, depending on hydrological conditions.

Monitoring is conducted in accordance with the Valley Water's 2016 GWMP, which prescribes sampling facilities within each recharge system every three years. Recharge systems selected for monitoring are typically sampled in May, July, and September to best characterize the water quality of water used for managed recharge operations and minimize affects from natural winter flows. Basic water quality parameters are monitored, including major and minor inorganics, anions, nutrients, TDS, total alkalinity, and field parameters (e.g., pH, dissolved oxygen, temperature). Organic parameters (e.g., herbicides, pesticides, and disinfection byproducts) are monitored at a subset of recharge facilities that are located near potentially contaminating activities such as industrial areas and highways.

In 2020, Valley Water did not conduct recharge monitoring due to the COVID-19 pandemic.

5.5 Monitoring Near Recycled Water Irrigation Sites

Valley Water partners with the four recycled water producers[11] in Santa Clara County to provide tertiary-treated disinfected recycled water (recycled water) for non-potable purposes such as landscape irrigation, agricultural irrigation, and industrial uses. Recycled water used in Santa Clara County generally has higher concentrations of salts, nutrients, disinfection byproducts, and emerging contaminants than local groundwater or imported water.[12] Previous studies have shown that some contaminants in recycled water can migrate to shallow groundwater as a result of recycled water irrigation.[13,14] To ensure groundwater resources remain protected as recycled water use expands, Valley Water monitors numerous sites[15] in the Llagas Subbasin where recycled water is provided by the South County Regional Wastewater Authority (SCRWA). Valley Water also receives groundwater

[10] Recharge Water Quality Monitoring Plan. September 2012. Groundwater Monitoring and Analysis Unit, Santa Clara Valley Water District.
[11] Recycled water is produced at the Palo Alto Regional Wastewater Quality Control Plant (PARWQCP), the Sunnyvale Water Pollution Control Plant (SWPCP), the San Jose/Santa Clara Regional Wastewater Facility (SJSCRWF), and the South County Regional Wastewater Authority (SCRWA). The branch of the SJSCRWF that produces recycled water is referred to as South Bay Water Recycling (SBWR).
[12] *Advanced Recycled Water Treatment Facility Project*. Black & Veatch and Kennedy/Jenks for the Santa Clara Valley Water District. August, 2003.
[13] *Fate and Transport of Wastewater Indicators: Results from the Ambient Groundwater and from Groundwater Directly Influenced by Wastewater*. California GAMA Program, Lawrence Livermore National Laboratory and California State Water Resources Control Board. June, 2006.
[14] *Recycled Water Irrigation and Groundwater Study: Santa Clara and Llagas Groundwater Subbasins*. Locus Technologies for Valley Water. August, 2011.
[15] These wells are referred to as the "South County wells".

data from SBWR, which monitors groundwater near sites[16] irrigated with recycled water in the Santa Clara Subbasin.

The 2020 recycled water sampling events are summarized in Table 10 and monitoring locations are shown in Figures 30 and 31. In general, low levels of parameters related to recycled water have been detected near recycled water irrigation sites but not at levels that warrant a recommendation to develop a corrective action plan or to discontinue recycled water irrigation.[17]

An analysis of long-term concentration trends was performed to evaluate water quality impacts of recycled water irrigation. The Mann-Kendall test was used to analyze trends as it does not require any assumptions as to the statistical distribution of the data (e.g., normal, lognormal, etc.) and allows for irregularly spaced measurement periods (i.e., variable sampling intervals).[18] The data are summarized in Tables 11 and 12.

For North County wells, the majority of parameters show stable or decreasing concentration trends; the exceptions are calcium, chloride, and magnesium (Table 11). It is unclear whether recycled water irrigation is the cause of the increasing concentration trends for calcium, chloride, and magnesium since historical data suggest that changes in these parameters pre-date recycled water irrigation in the area.[19] A geochemical analysis indicates that groundwater from most of the deep North County wells has an ionic composition more similar to ambient groundwater than to recycled water; the geochemical analysis of groundwater from the shallow North County wells is inconclusive and suggests that multiple geochemical processes are in place, including the possibility of recycled water mixing with groundwater.

For South County wells, the majority of parameters also show stable or decreasing concentration trends; the parameter with the largest number of increasing concentration trends is sodium (five wells), followed by potassium and sulfate (each four wells; Table 12). Most of the wells with increasing concentration trends are either located at the SCRWA facility or at Christmas Hill Park in Gilroy, an area that has received recycled water the longest of all monitored sites. These results may be due to the influence of secondary effluent from the settling ponds at the SCRWA facility or recycled water irrigation (both sites). However, a geochemical analysis indicates that, with the exception of the three shallow wells at the SCRWA facility[20], groundwater from all other wells has an ionic composition more similar to ambient groundwater than to recycled water.

A more detailed description of the geochemical evaluations and statistical analyses of long-term concentration trends as well as summary statistics of monitoring results is presented in Appendix D.

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[16] These wells are referred to as the “North County wells”
[17] These results are correlative; hence, other sources besides recycled water may play a role in the detection of these parameters.
[18] *Appendix A.2.: Statistical Trends Analysis Methods.* GSI and Air Force Center for Environmental Excellence. February 2007.
[19] Based on historical data from SBWR, summarized in the 2018 Annual Groundwater Report
[20] The three shallow wells at SCRWA have an ionic composition more similar to recycled water than to ambient groundwater.

Table 10. Summary of 2020 Groundwater Monitoring Events Near Recycled Water Irrigation Sites

Subbasin	Location	Sampling Agency	Sampling Summary
Santa Clara Subbasin (Santa Clara Plain)	Various Locations in San Jose	South Bay Water Recycling (SBWR)	• Groundwater from five shallow wells and four deep wells was monitored in February through April 2020 by the City of San Jose per their Groundwater Mitigation and Monitoring Plan (GMMP).
Llagas Subbasin	Christmas Hill Park, Gilroy	Valley Water	• Groundwater from three shallow wells was sampled in June and October 2020. • Recycled water delivered to this site was sampled in June and October 2020.
	Irrigated Land Near SCRWA Plant, Gilroy	Valley Water	• Groundwater from three shallow wells and one deep well was sampled in June and October 2020 • Recycled water delivered to the site from the SCRWA plant was sampled in June and October 2020
	Irrigated Land Along Expanded Recycled Water Pipelines (West Gilroy)	Valley Water	• Groundwater from 12 shallow monitoring wells was sampled in June 2020 and groundwater from 11 shallow wells was sampled in October 2020 (one well was dry).

Figure 30. Groundwater Monitoring Near Santa Clara Subbasin Recycled Water Irrigation Sites

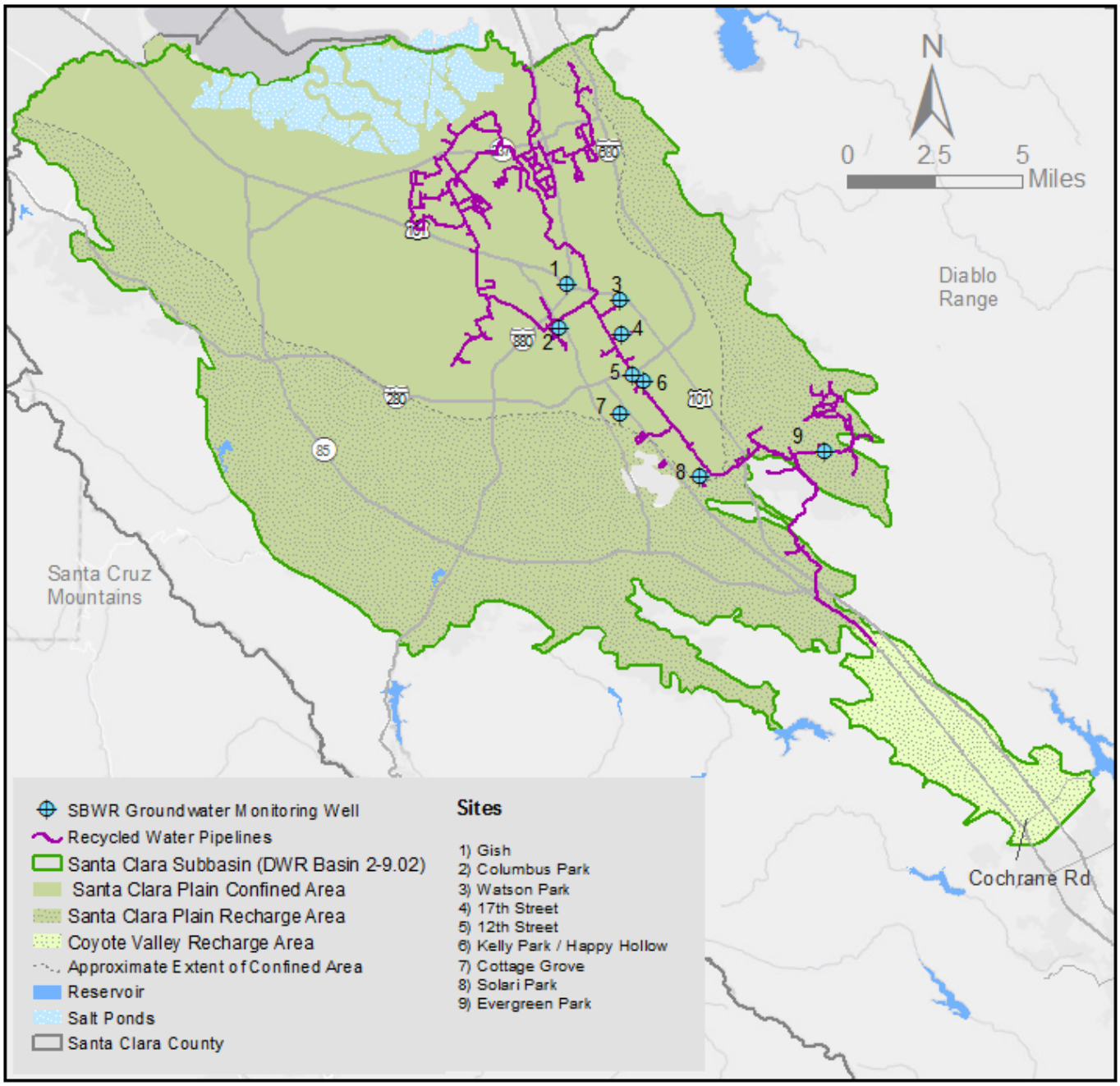

Figure 31. Groundwater Monitoring Near Llagas Subbasin Recycled Water Irrigation Sites

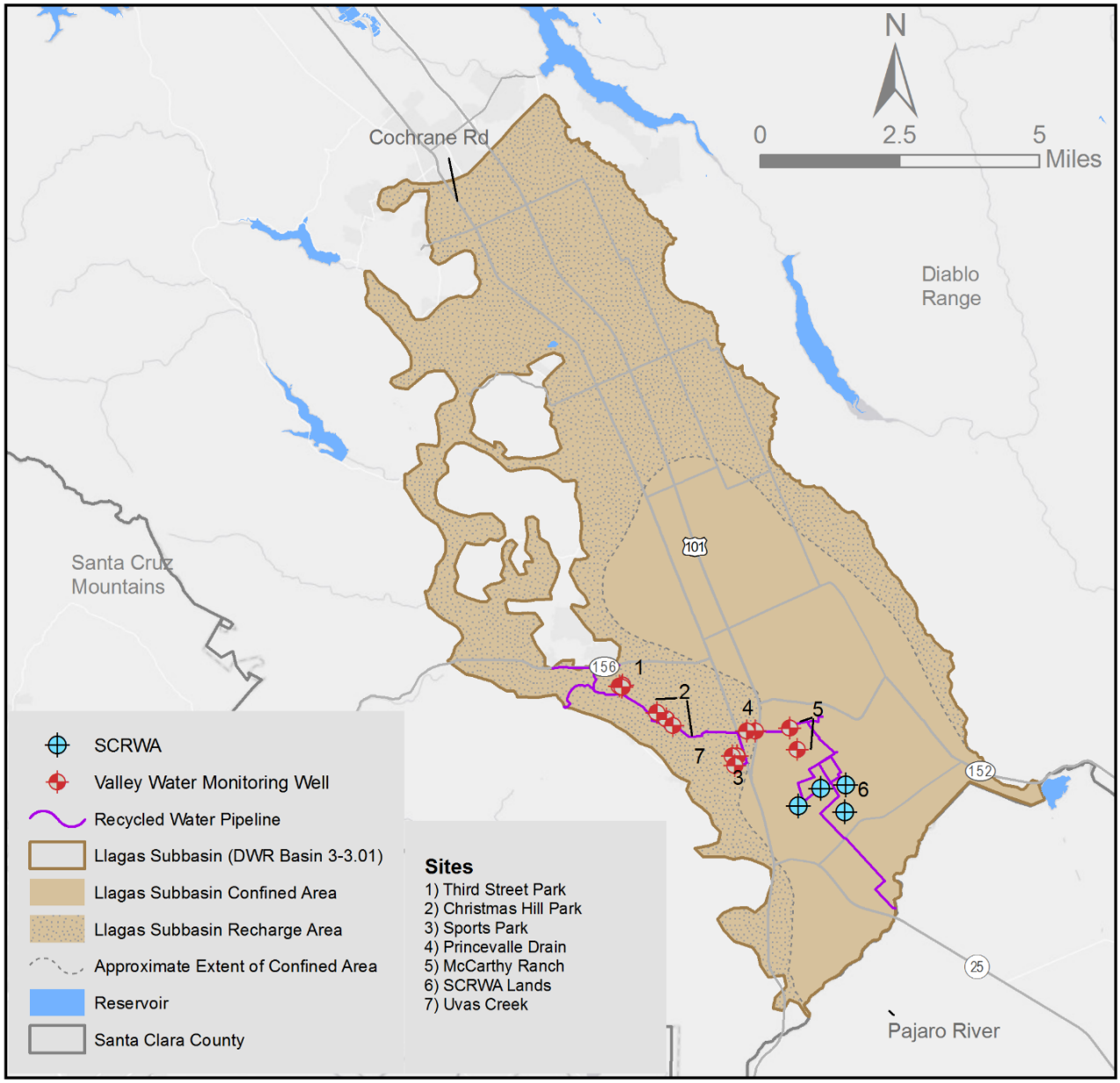

Table 11. Groundwater Concentration Trends at Santa Clara Plain Recycled Water Irrigation Sites

Parameter	Number of Wells with Increasing Concentrations	Number of Wells with Stable Concentrations	Number of Wells with Decreasing Concentrations
Bicarbonate	1	5	3
Calcium	7	1	1
Chloride	5	4	0
Magnesium	5	2	2
Nitrate	3	2	4
Potassium	4	3	2
Sodium	4	4	1
Sulfate	4	2	3
Total Dissolved Solids (TDS)	4	3	2

Table 12. Groundwater Concentration Trends at Llagas Subbasin Recycled Water Irrigation Sites

Parameter	Number of Wells with Increasing Concentrations	Number of Wells with Stable Concentrations	Number of Wells with Decreasing Concentrations
Bicarbonate	1	15	3
Bromide	1	14	4
Calcium	1	17	1
Chloride	3	14	2
Magnesium	2	16	1
Nitrate	1	16	2
N-Nitrosodimethylamine (NDBA)	0	19	0
N-Nitrosodi-n-Butylamine (NDMA)	2	17	0
Perfluorooctanoic acid (PFOA)	0	17	2
Perfluorooctane Sulfonate (PFOS)	0	12	7
Potassium	4	15	0
Sodium	5	14	0
Sulfate	4	15	0
Total Dissolved Solids (TDS)	0	18	1

5.6 PFAS Sampling

PFAS encompass a group of over 6,300 substances. PFAS have a wide range of physical and chemical properties, all of which affect their fate and transport in the environment, though most PFAS repel oil and water, tolerate temperature extremes, and are resistant to degradation. PFAS have been extensively used in consumer products including non-stick coatings, sunscreens, carpets, textiles, paper products, clothing, and firefighting foams. Due to their many uses, PFAS are widely distributed in the environment. PFAS have been called "Forever Chemicals" as they are very stable as well as persistent in the environment and human body.

Two PFAS, perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS), are found in the blood and serum of most human populations worldwide.[21] Peer-reviewed studies using laboratory animal models and human epidemiological data have documented a number of adverse health effects due to PFAS exposure including (but not limited to) increased cholesterol, liver disease, decreased fertility, developmental effects to fetuses, lower birth weights, thyroid disease, immune system effects, and several types of cancer.[22]

PFAS health advisory levels and regulations are evolving rapidly at both the State and Federal level. The California State Water Resources Control Board (State Board) has established a notification level (NL) of 5.1 parts per trillion (ppt) for PFOA, 6.5 ppt for PFOS, and 500 ppt for Perfluorobutanesulfonic acid (PFBS).[23,24] If the NL is exceeded, water providers are required to notify their governing bodies and it is recommended that they inform customers. The State Board has also set a response level (RL) of 10 ppt for PFOA, 40 ppt for PFOS, and 5 parts per billion (micrograms per liter) for PFBS.[25] If the RL is exceeded, the water providers must either provide treatment, remove the drinking water source from service, or provide direct public notification.[26]

The California Office of Environmental Health Hazard Assessment (OEHHA) is in the process of developing Public Health Goals for PFOA and PFOS, the first step in developing an enforceable MCL for these compounds; MCLs for PFOA and PFOS are expected by 2025. The State Board has also requested OEHHA to develop NLs for an additional six PFAS: perfluorohexane sulfonic acid (PFHxS), perfluorohexanoic acid (PFHxA), perfluoroheptanoic acid (PFHpA), perfluorononanoic acid (PFNA), perfluorodecanoic acid (PFDA), and Dodecafluoro-3H-4,8-dioxanonanoic acid (ADONA). In 2020 the

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[21] United States Environmental Protection Agency. *EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan*. 2019. https://www.epa.gov/sites/production/files/2019-02/documents/pfas_action_plan_021319_508compliant_1.pdf

[22] Ibid.

[23] Within the State Board, the Division of Drinking Water is responsible for setting NLs and RLs for PFAS. In August 2019, the NL for PFOA was lowered from 14 ppt to 5.1 ppt and the NL for PFOS was lowered from 13 ppt to 6.5 ppt.

[24] California State Water Resources Control Board. *Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS) 2019*. https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/PFOA_PFOS.html. https://www.waterboards.ca.gov/drinking_water/programs/documents/pfbs_nl_issuance_03052021_final_signed.pdf

[25] Ibid.

[26] From a regulatory standpoint, the NLs and RLs only apply to potable water supplies.

EPA made a regulatory determination to proceed with developing regulations for PFOA and PFOS; MCLs are expected by late 2023.

Beginning in 2019 the State Board issued PFAS Investigative Orders to public water systems, airports, municipal and solid waste landfills, chrome plating facilities, and publicly owned treatment works. The goals of the PFAS Investigative Orders were to identify impacted public water supply wells, define areas for future investigations, and inform the development of PHGs and MCLs. Within Santa Clara County, the State Board ordered testing of three wells owned by Valley Water (the Campbell Well Field (CWF)), 17 wells owned by San Jose Water Company (SJWC), three wells owned by the City of Santa Clara, six landfills, one well owned by a private entity,[27] and the San Jose Norman Mineta International Airport. The State Board's PFAS Investigative Orders required four quarters of monitoring for public water supply wells. For airports and landfills, the State Board's PFAS Investigative Orders required a site investigation which included a technical report with results from groundwater and leachate monitoring (landfills) and results from groundwater and soil monitoring (airports).[28]

In addition to the wells covered under the State Board's PFAS Investigative Order, SJWC voluntarily sampled the remainder of its 96 public supply wells. The City of Sunnyvale voluntarily sampled all seven of its public supply wells. Figure 32 provides a summary of retailer and Valley Water PFAS sampling sites.

There were no PFAS detections in any of the wells sampled by the City of Santa Clara or the City of Sunnyvale. For the SJWC wells, PFOA was detected in two wells at levels slightly above the method reporting limit (MRL) of 2 ppt (Figure 34); PFOS was frequently detected above the MRL and was detected above the NL in ten wells located at three stations: Williams Rd, Willow Glen Way, and Malone Rd (Figure 36).[29] Out of an abundance of caution, SJWC took these wells with PFOS levels above the NL out of service and sent notification letters to customers; SJWC is exploring treatment options for these wells. Other PFAS sometimes detected in SJWC wells include PFBS and PFHxS. Valley Water and the water retailer with the PFAS impacted wells initiated quarterly meetings with the San Francisco Regional Water Quality Control Board and DDW in October 2020 to address regional and retailer specific concerns related to PFAS.

Several PFAS were detected at levels slightly above their MRL (2 ppt) at the CWF, including PFHxS, PFHpA, PFHxA, PFOA, and PFOS.[30] Neither PFOA nor PFOS were ever detected above their NL during all four quarters of monitoring at the CWF (Figures 34 and 36).

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[27] HKN, which is located near Kirby Canyon Landfill. HKN was only monitored for one quarter instead of four quarters like the others.
[28] Landfills: California State Water Resources Control Board. 2019. *Water Code Section 13267 Order for the Determination of the Presence of Per- and Polyfluoroalkyl Substances. Order WQ 2019-0006-DWQ.* https://www.waterboards.ca.gov/pfas/docs/landfill_pfas_13267_go_03202019.pdf
Airports: California State Water Resources Control Board. 2019. *Water Code Section 13267 Order for the Determination of the Presence of Per- and Polyfluoroalkyl Substances Order WQ 2019-005-DWQ* https://www.waterboards.ca.gov/pfas/docs/airport_pfas_13267_go_03202019.pdf
[29] PFOS was detected above the NL in eight active wells and two standby wells.
[30] EPA Method 537.1 was used for all four quarters of monitoring at CWF.

In February 2020[31], Valley Water voluntarily sampled PFAS at 55 regional monitoring wells to better understand the distribution and occurrence of PFAS in the county. PFOA and PFOS were not widely detected above the NL in these wells. PFOA was detected above the NL in two wells, the Los Esteros well at 111 ppt (also above the RL of 10 ppt) and the Carnadero well at 7 ppt (Figures 33 and 34). PFOS was detected above the NL and RL in two wells, the Los Esteros well at 213 ppt and the Permanente well at 24 ppt (Figures 35 and 36). PFOS was also detected slightly above the NL in another well, the Willow #6 well.[32] The Los Esteros, Permanente, and Willow #6 wells are in the Santa Clara Plain (of the Santa Clara Subbasin) while the Carnadero well is in the Llagas Subbasin. In total, PFOA was detected above the MRL in four monitoring wells while PFOS was detected above the MRL in 12 wells. Other PFAS sometimes detected above the MRL in these monitoring wells included PFBS, PFHxS, and PFHxA.

Valley Water also sampled a group of five monitoring wells in Campbell, the Morgan Park Wells, to gather baseline water quality data in preparation for indirect potable reuse, which is planned for implementation at the ponds within the Los Gatos Recharge System. PFOA and PFOS exceeded their NLs in one well and two wells, respectively. PFBS, PFHPA, PFHxA, PFHxS, and PFNA were also detected at low concentrations (2.08 to 2.92 ppt).

Valley Water continues to evaluate and analyze PFAS data from all sources including data from State Board-mandated sampling, contaminant release sites, Valley Water sampling including recycled water monitoring (Section 5.5 and Appendix D), and voluntary monitoring by water retailers. Valley Water will continue to collaborate with water retailers and regulatory agencies to better understand PFAS occurrence, evaluate potential sources, and identify any actions that may be needed to protect local water supplies.

[31] Regional Wells in which PFOA or PFOS were detected in February 2020 were sampled again in October 2020 to confirm/verify detections. Values given are an average of the two measurements.
[32] This well was resampled in October 2020 because the February 2020 value for PFOS, 6 ppt, was slightly below the NL (and above the MRL). In October 2020 the value for PFOS for this well was slightly above the NL at 7.54 ppt.

Figure 32. PFAS Sampling Sites

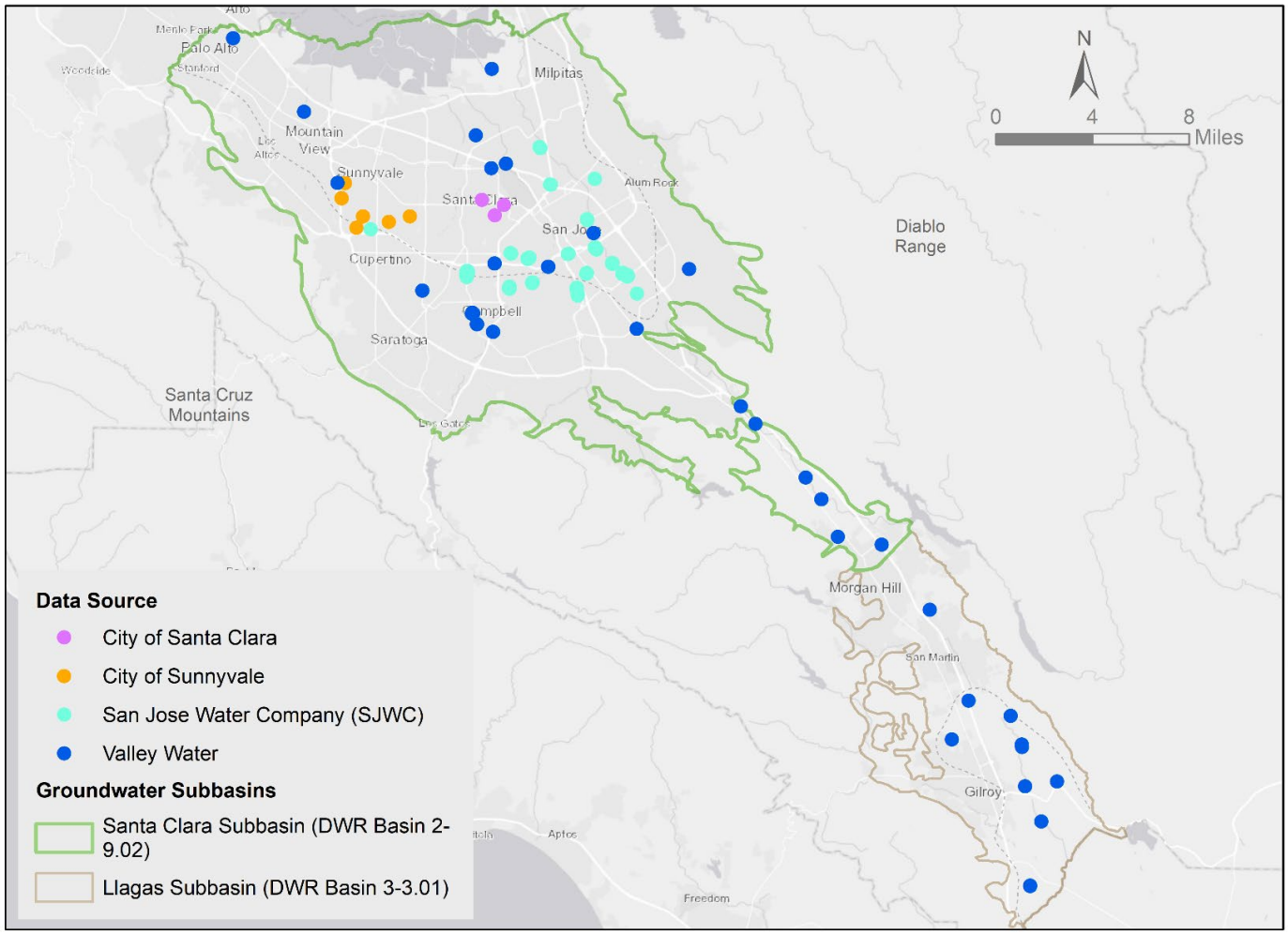


Figure 33. PFOA Detections in the Shallow Aquifers (2018 – 2020)

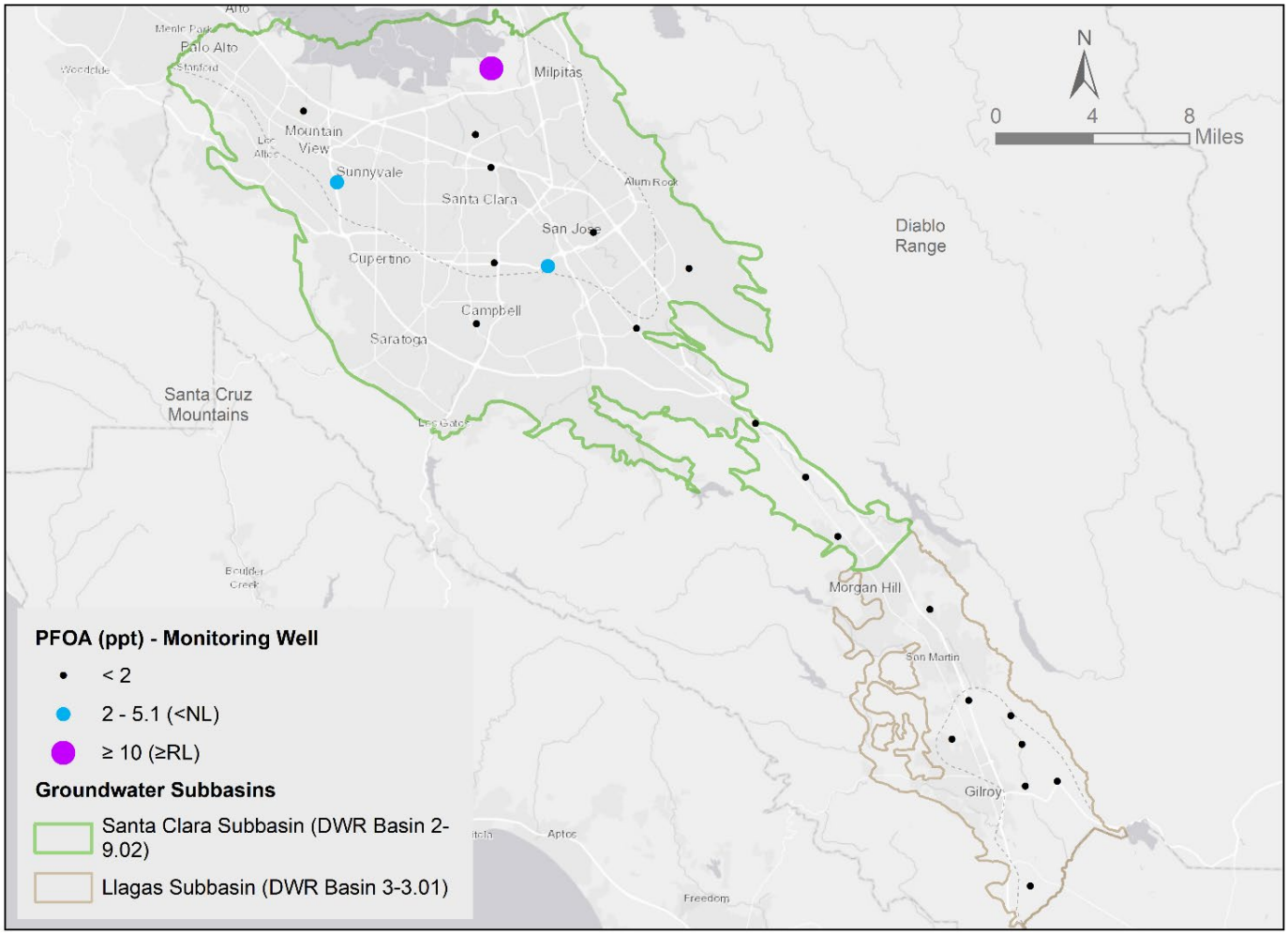


Figure 34. PFOA Detections in the Principal Aquifers (2018 – 2020)

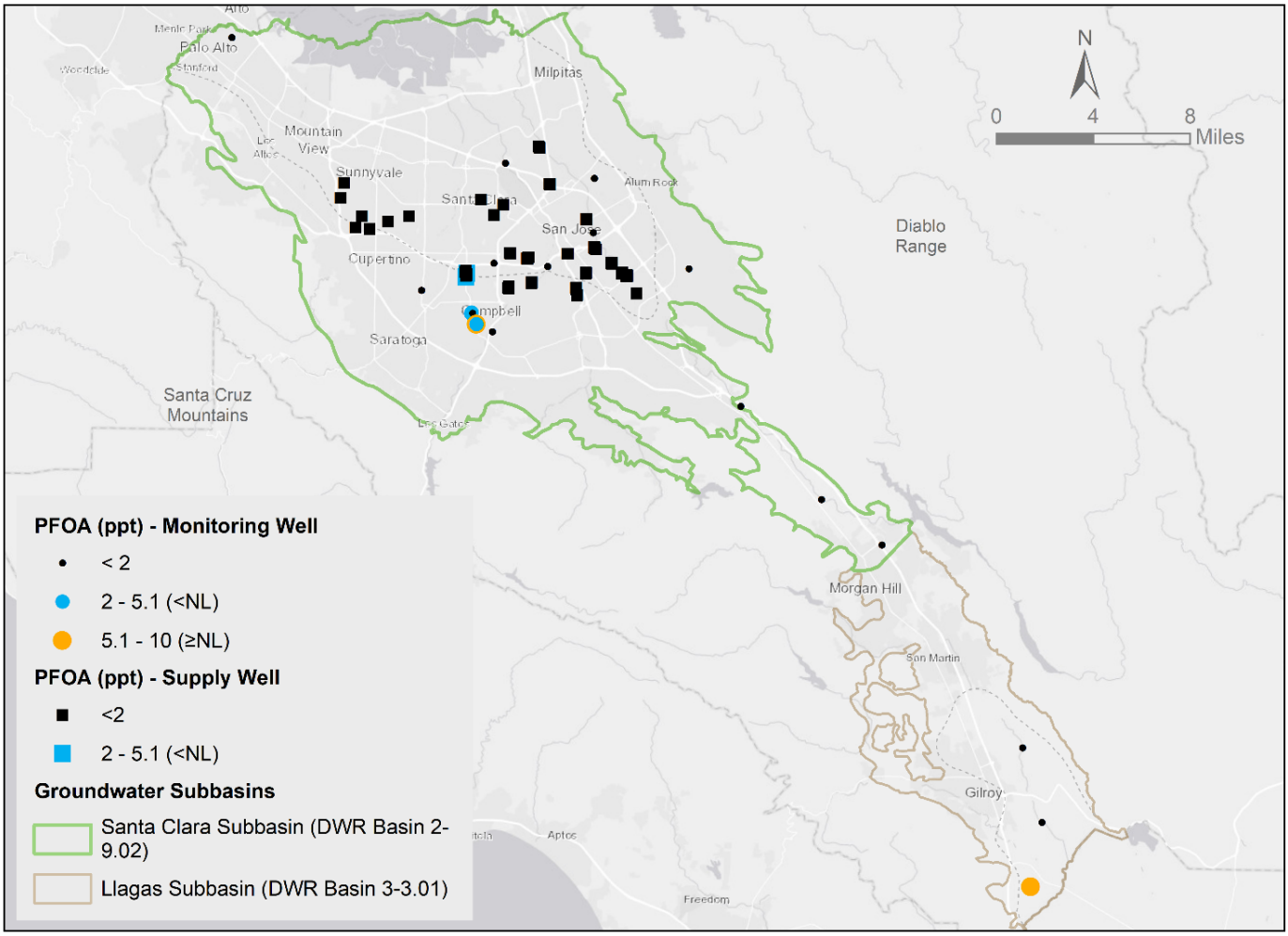


Figure 35. PFOS Detections in the Shallow Aquifers (2018 – 2020)

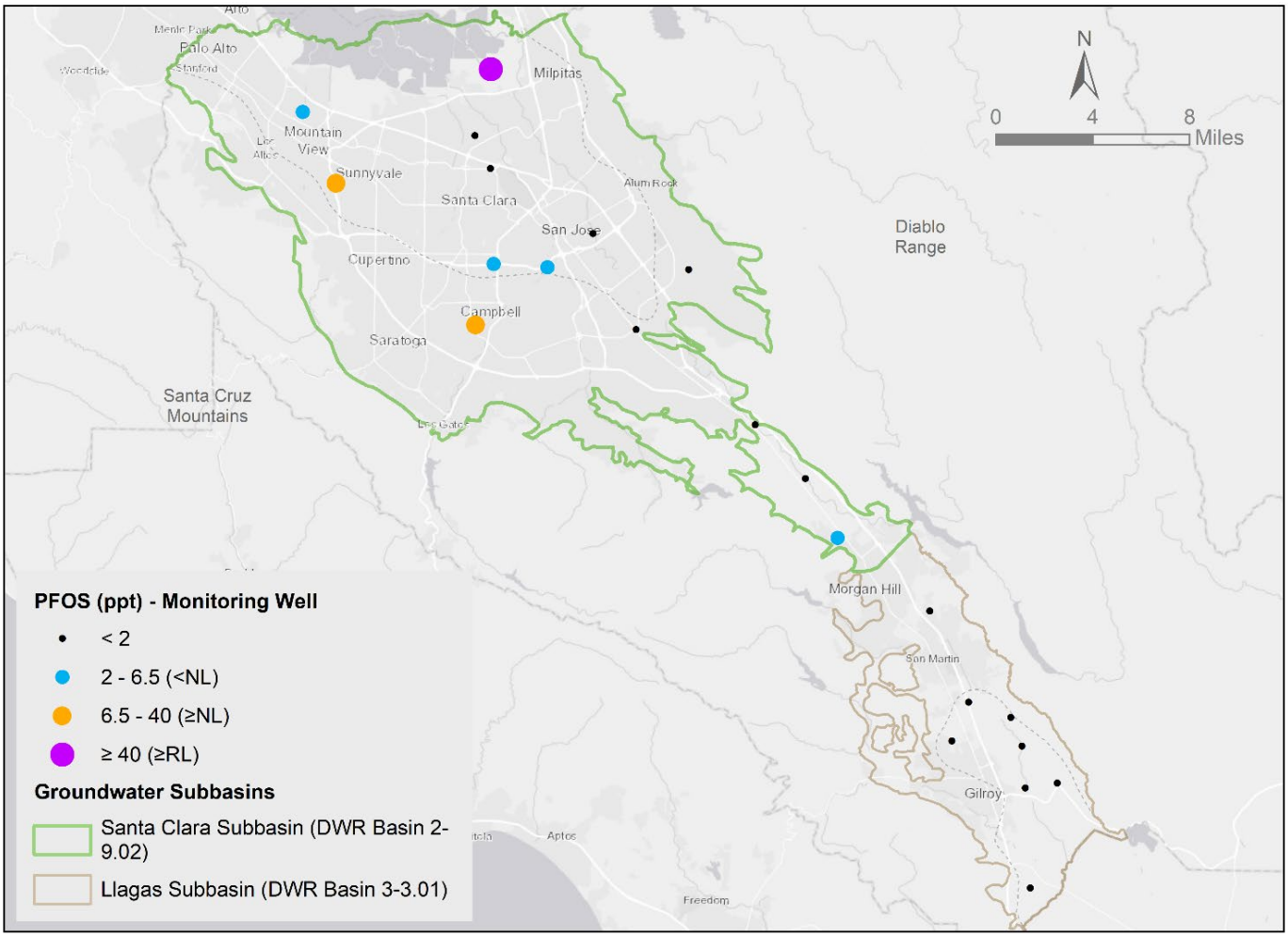
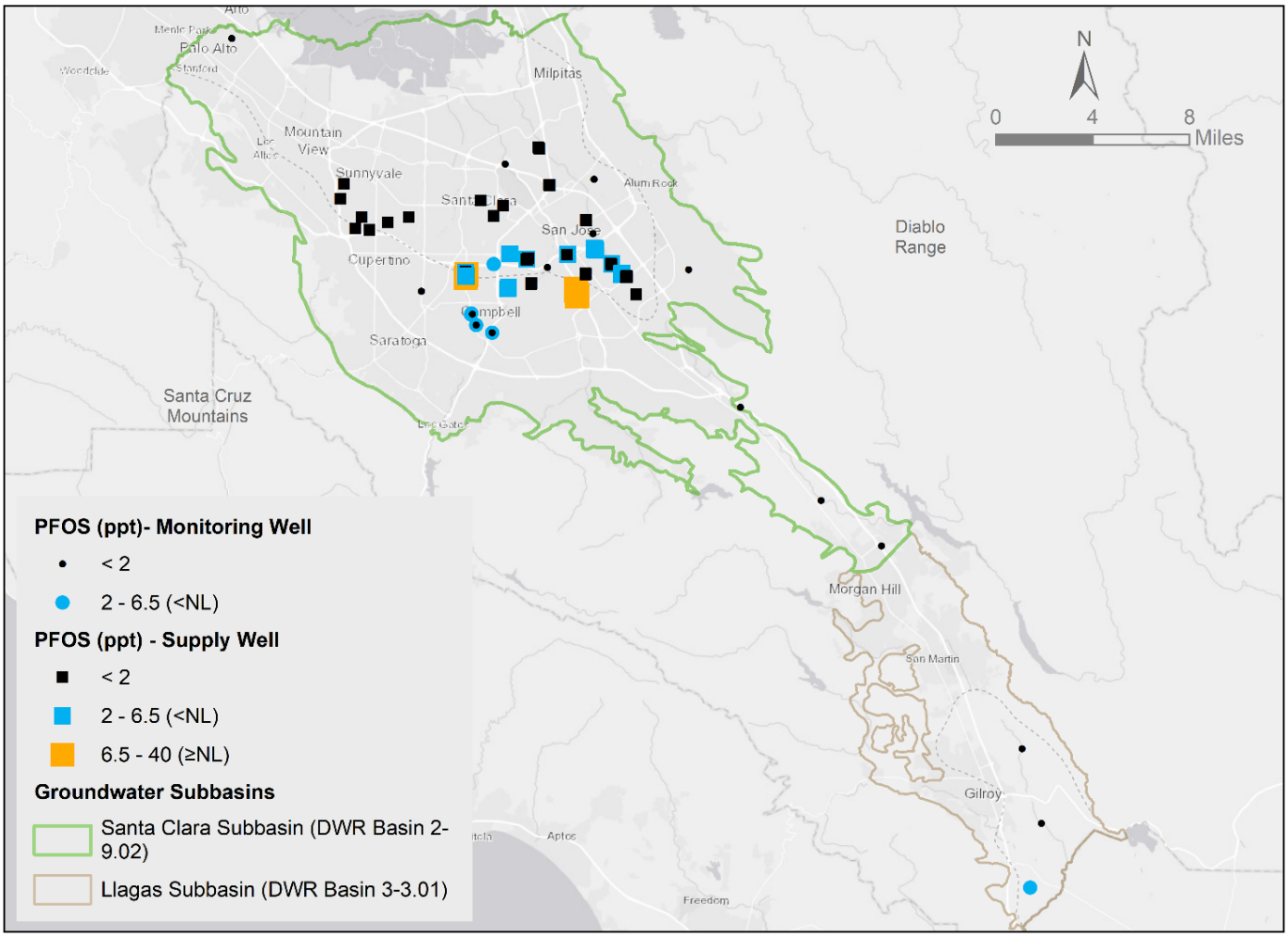


Figure 36. PFOS Detections in the Principal Aquifers (2018 – 2020)



5.7 Salt and Nutrient Management Plans

The SWRCB's 2009 Recycled Water Policy required the development of regional Salt and Nutrient Management Plans (SNMPs) to address current and future regional salt and nutrient loading to groundwater from all sources, including recycled water and agricultural activity. Valley Water completed separate SNMPs for the Santa Clara and Llagas subbasins by working with local stakeholders and regulators. The plans are posted to Valley Water's website[33] and include salt and nutrient source identification, loading, assimilative capacity estimates, recycled water projections, implementation measures, groundwater monitoring provisions, and an anti-degradation analysis. The San Francisco Bay Regional Water Quality Control Board adopted resolution R2-2016-0046 approving the Santa Clara Subbasin SNMP in November 2016. The Central Coast Regional Water Quality Control Board does not plan to endorse specific SNMPs. Both agencies will use these plans to evaluate future recycled water projects.

The SNMPs estimate and project long-term trends in concentrations of salts (using TDS) and nutrients (using nitrate) in groundwater through the year 2035. In general, the main sources for salt loading in the Santa Clara Plain are landscape irrigation and managed recharge, followed by recycled water, whereas agricultural irrigation and managed recharge are the main contributors for the Llagas Subbasin. Table 13 compares the SNMP projections for 2020 with the median values based on groundwater samples collected in 2020.

Table 13. Comparison of 2020 Median Concentrations With Projected 2020 SNMP Median Concentrations

Groundwater Management Area	2020 SNMP Projected Median	2020 Actual Median	2020 SNMP Projected Median	2020 Actual Median
	TDS, in mg/L		Nitrate as N, in mg/L	
Santa Clara Plain	435	420	2.2	2.9
Coyote Valley	310	334	3.1	1.3
Llagas Subbasin, Shallow Zone	396	398	6.9	10
Llagas Subbasin, Principal Zone	376	375	6.4	5.3

Notes:

1. The projected medians are based on the 2020 estimates from the SNMPs. The actual medians are based on 2020 groundwater sample analysis. The Llagas Subbasin SNMP projects separate medians for the northern and southern portions of the subbasin. The projected SNMP median shown is the average of the north and south subbasin medians.
2. June 2016 SNMP Santa Clara Plain projected median concentrations were not evaluated for shallow and principal aquifer zones separately.

[33] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater/groundwater-studies

Measured median concentrations of TDS and nitrate are generally in line with SNMP projections except for nitrate in the Llagas Subbasin shallow aquifer zone. Discrepancies may be attributed to higher than normal nitrate concentrations during 2020 due to drought conditions.

Both projected and actual measured medians remain below water quality thresholds established in the Regional Water Quality Control Board's Basin Plans for the Santa Clara and Llagas subbasins. As shown in Table 7 and Figures 25 and 26, regional trends for both TDS and nitrate concentrations are generally stable or decreasing in the Santa Clara Plain, Coyote Valley, and the Llagas Subbasin. Valley Water will continue to evaluate measured and projected TDS and nitrate concentrations and their relationship to hydrologic conditions to better understand the causes for fluctuations including the effects on shallow and principal groundwater aquifers.

5.8 Contaminant Release Sites

There are over 400 open cases in Santa Clara County where non-fuel contaminants have been released to soil and groundwater. These cases are overseen by the EPA, California Department of Toxic Substances Control (DTSC), and the Central Coast and San Francisco Bay Regional Water Quality Control Boards (Water Boards). There are also nearly 70 open fuel leak cases overseen by the Santa Clara County Department of Environmental Health (DEH). Of these, approximately 18 are undergoing site assessment, 8 are undergoing site assessment and interim remediation, 8 are undergoing remediation, 16 are undergoing verification monitoring, and 11 are eligible for closure. Additionally, there are over 20 active Superfund sites in Santa Clara County overseen by the EPA. Although there have been very limited impacts to principal drinking water aquifers from these sites, contaminant release sites pose an ongoing threat to groundwater quality.

In 2020, 71 drinking water supply wells had low-level detections of 17 different VOCs.[34] All concentrations of these detected contaminants were below regulatory thresholds, as summarized in Appendix C, Table C-4. The increased number of wells with detected VOCs in 2020 (compared to 52 in 2019) is due to a significant increase in the number of water supply wells tested for VOCs, especially PFAS (due to mandated and voluntary testing). The interconnection between contaminant releases and drinking water supply wells underscores the importance of the ongoing work by the Water Boards, DTSC, EPA, and other regulatory agencies to ensure that contaminant release sites are properly remediated to promote water supply reliability.

Valley Water engages with the primary oversight agencies on certain contaminant release cases based on groundwater vulnerability, proximity to water supply wells or surface water, and contaminant concentration by reviewing monitoring and progress reports, regulatory orders, and correspondence submitted to regulatory agencies. Valley Water is engaged in community meetings for high-threat cases, advocates for expedited cleanup through collaboration with regulatory agencies, provides technical review of other contaminant release sites when requested by regulatory agencies, and shares groundwater data to support their work.

[34] None of the wells with VOC detections had all compounds detected; typically, just one or a few related compounds were detected in a single well.

5.9 Well Ordinance Program

Valley Water's well ordinance program helps ensure wells and other deep excavations are properly constructed, maintained, and destroyed to prevent vertical transport of contaminants into deep drinking water aquifers. Nearly 1,100 permits were issued in 2020 for well construction, well destruction, and exploratory borings. Valley Water inspected over 1,200 wells and borings to ensure they were properly constructed or destroyed (Table 14).

Table 14. CY 2020 Valley Water Well Permit and Inspection Summary

Permit Type	Number Processed
Well Construction - Water Producing Wells	56
Well Construction - Monitoring Wells	383
Well Destruction	412
Exploratory Boring	226
TOTAL	**1,077**
Inspection Type	**Number Inspected**
Well Construction - Water Producing Wells	58
Well Construction - Monitoring Wells	360
Well Destruction	303
Exploratory Boring	443
TOTAL	**1,164**

Groundwater Quality Outcome Measures

The evaluation of 2020 groundwater quality data relative to the GWMP outcome measures is summarized below. Additional discussion of outcome measures, including planned action to address measures not being met, is presented in Chapter 6.

OM 2.1.1.e. At least 95% of countywide water supply wells meet primary drinking water standards. **Outcome measure met**. 96% of countywide water supply wells tested in 2020 met all primary drinking water standards; 100% of countywide water supply wells met all primary drinking water standards when excluding nitrate exceedances.

OM 2.1.1.f. At least 90% of Coyote Valley and Llagas Subbasin wells meet Basin Plan agricultural objectives. **Outcome measure met**. This measure is met with 100% of all Coyote Valley and Llagas Subbasin wells meeting Basin Plan agricultural objectives in 2020.

OM 2.1.1.g. At least 90% of wells have stable or decreasing concentrations of nitrate, chloride, and total dissolved solids. **Outcome measure partially met**. This measure is not met for chloride, with only 81% of wells having stable or decreasing concentrations. The measure is met for nitrate and total dissolved solids, with stable or decreasing concentrations observed in 93% and 91% of wells, respectively.

CHAPTER 6

Groundwater Management Plan Implementation

CHAPTER 6 – GROUNDWATER MANAGEMENT PLAN IMPLEMENTATION

This chapter summarizes the status of Valley Water's Groundwater Management Plan (Plan) implementation, including outcome measure performance, recommendations, and SGMA compliance.

6.1 Outcome Measure Performance and Action Plan

The Plan identifies outcome measures to assess performance relative to Board policy and groundwater sustainability goals. The status using 2020 data is shown below, with related actions to address measures not being met.

Table 15. Summary of Outcome Measure Performance

Groundwater Storage	**OM 2.1.1.a.** Greater than 278,000 AF of projected end of year groundwater storage in the Santa Clara Plain. **Outcome measure met:** End of 2020 groundwater storage is 300,000 AF.
	OM 2.1.1.b. Greater than 5,000 AF of projected end of year groundwater storage in the Coyote Valley. **Outcome measure met:** End of 2020 groundwater storage is 13,400 AF.
	OM 2.1.1.c. Greater than 17,000 AF of projected end of year groundwater storage in the Llagas Subbasin. **Outcome measure met**: End of 2020 groundwater storage is 23,700 AF.
Groundwater Levels and Subsidence	**OM 2.1.1.d.** 100% of subsidence index wells with groundwater levels above subsidence thresholds. **Outcome measure met**: This outcome measure was met. Groundwater levels were above subsidence thresholds at all ten Santa Clara Plain subsidence index wells.
Groundwater Quality	**OM 2.1.1.e.** At least 95% of countywide water supply wells meet primary drinking water standards. **Outcome measure met**: 96% of countywide water supply wells tested in 2020 met all primary drinking water standards; 100% of countywide water supply wells met all primary drinking water standards when excluding nitrate exceedances. **OM 2.1.1.f.** At least 90% of Coyote Valley and Llagas Subbasin wells meet Basin Plan agricultural objectives. **Outcome measure met:** This measure is met with 100% of all Coyote Valley and Llagas Subbasin wells meeting Basin Plan agricultural objectives in 2020.
Groundwater Quality Trends	**OM 2.1.1.g.** At least 90% of wells have stable or decreasing concentrations of nitrate, chloride, and total dissolved solids. **Outcome measure partially met**: This measure is not met for chloride, with only 81% of wells having stable or decreasing concentrations. The measure is met for nitrate and total dissolved solids, with stable or decreasing concentrations observed in 93% and 91% of wells, respectively.
	Action Plan for OM 2.1.1.g. Implement Salt and Nutrient Management Plans to address salt loading, continue collaborating with regulatory and land use agencies.

As shown in Table 15, all outcome measures related to groundwater storage, levels, and land subsidence were met in 2020. While 2020 marked the beginning of another drought, groundwater conditions heading into the year were healthy with groundwater levels and storage fully recovered from the 2012-2016 drought.

While most wells have stable or decreasing long-term chloride, nitrate, and total dissolved solids concentration trends, some upward trends were observed and warrant further evaluation. Valley Water will assess the potential cause, continue to implement the Salt and Nutrient Management Plans, and engage with regulatory and/or land use agencies as needed.

Elevated nitrate continues to be the primary groundwater protection challenge, particularly in South County. This condition is not unique to Santa Clara County as nitrate contamination is an issue in many agricultural or rural areas throughout California and the United States. Long-term nitrate trends in Santa Clara County indicate stable or improving conditions, which is certainly preferable to worsening conditions. However, a significant number of South County wells (primarily domestic wells) still contain nitrate above the drinking water standard. Valley Water does not control land use or have regulatory authority over activities with the most nitrate loading to groundwater, such as irrigated agriculture or septic systems. However, Valley Water continues to coordinate with land use and regulatory agencies to influence policies, regulations, and decisions related to nitrate management. More directly, Valley Water's managed recharge programs help dilute nitrate in groundwater, and water quality testing help to reduce well owner exposure.

PFAS does not appear to be a widespread regional concern in groundwater of Santa Clara County based on mandated and voluntary sampling of water supply and monitoring wells by water retailers and Valley Water. However, SJWC detected PFOS above its NL in 10 water supply wells and removed those wells from service out of an abundance of caution. Valley Water will continue to work with our customers and regulatory agencies on PFAS.

6.2 Status of Groundwater Management Plan Recommendations

As described in the Plan and demonstrated in this report, Valley Water's proactive groundwater management programs and activities have maintained sustainable groundwater levels and storage, minimized land subsidence, and improved groundwater protection. The Plan presents six major recommendations to maintain the long-term viability of groundwater resources. A summary of the status of each recommendation is below.

1. **Maintain existing conjunctive water management programs and evaluate opportunities for enhancement or increased efficiency.**

   This Plan recommendation has several sub-recommendations, including items related to infrastructure reliability, high-priority capital project implementation, and securing imported water sources, among others. Valley Water continues to focus on extensive groundwater recharge through direct replenishment and in-lieu recharge. Updates relative to this Plan recommendation are presented below.

Capital Projects Supporting Conjunctive Management

Valley Water's Fiscal Year 2023-27 Five-Year Capital Improvement Program (CIP) was authorized for release by the Board of Directors on February 22, 2022.[1] With a significant portion of Valley Water's water supply infrastructure approaching fifty to sixty years of age, maintaining and upgrading the existing infrastructure to ensure each facility functions as intended for its useful life became the focus of the Water Supply CIP in recent years. Other CIP projects focus on expanding in-lieu and direct recharge through recycled and purified water projects. Major water supply capital improvements identified in the CIP include:

Storage:

- Almaden Dam Improvements
- Anderson Dam Seismic Retrofit
- Calero Dam Seismic Retrofit
- Guadalupe Dam Seismic Retrofit
- Pacheco Reservoir Expansion
- Dam Seismic Stability Evaluation
- Coyote Pumping Plan ASD Replacement
- Coyote Warehouse
- Small Capital Improvements, San Felipe Reaches 1-3

Transmission:

- 10-Year Pipeline Rehabilitation
- Fisheries and Aquatic Habitat Collaborative Effort (FAHCE) Implementation
- Vasona Pumping Plant Upgrade
- Almaden Valley Pipeline Replacement
- Distribution System Implementation Project
- IRP2 Additional Line Valves (A3)
- Pacheco/Santa Clara Conduit Right of Way Acquisition
- SCADA Implementation Project
- Small Capital Improvements, Raw Water Transmission
- Small Capital Improvements, Treated Water Transmission
- Treated Water Isolation Valves

[1] The 2023-27 CIP is available at: https://www.valleywater.org/how-we-operate/five-year-capital-improvementprogram

Water Treatment Plants (WTP):

- Penitencia Water Treatment Plant Residuals Management
- Penitencia Water Treatment Plant Residuals Remediation
- Rinconada Water Treatment Plant Reliability Improvement
- Santa Teresa Water Treatment Plant Filter Media Replacement
- Water Treatment Plant Electrical Improvement
- Small Capital Improvements, Water Treatment
- Water Treatment Plant Implementation Project

Recycled Water:

- Expedited Purified Water Project
- South County Recycled Water Pipeline
- Land Rights – South County Recycled Water Pipeline

Detailed information on each of these water supply capital projects, including related description, costs, and schedule, is available in the CIP.

2. Continue to aggressively protect groundwater quality through Valley Water programs and collaboration with land use agencies, regulatory agencies, and basin stakeholders.

A reliable water supply depends not only on quantity, but on quality. Sub-recommendations from the Plan include continued groundwater quality monitoring, action when potentially adverse trends are identified, and continued and enhanced collaboration with local partners and stakeholders.

Groundwater quality is typically very good in the county, with no treatment beyond disinfection required at major retailer wells. However, nitrate remains an ongoing groundwater protection challenge, particularly in the more rural Coyote Valley and Llagas Subbasin. Valley Water continues to conduct extensive groundwater quality monitoring, evaluate long-term trends, and compare current conditions against regulatory standards and projected concentrations (such as from Salt and Nutrient Management Plans).

Long-term trends are favorable for nitrate, with 93% of wells tested showing stable or decreasing concentrations. However, since a significant number of domestic wells in the Llagas Subbasin still contain nitrate above the drinking water standard, more work remains to be done. Valley Water will continue to engage with regulatory and land use agencies to address existing nitrate contamination. For nitrate and other water quality issues, Valley Water will work to build and enhance this collaboration to protect high-quality groundwater and expedite the restoration of impacted groundwater.

Valley Water is working with land use agencies on a Stormwater Resources Plan to increase infiltration while ensuring pollutants from urban runoff are not merely transmitted from surface water to groundwater. Similarly, Valley Water continues to engage with various entities to ensure that recycled water expansion or the use of purified water for recharge will be protective of groundwater quality.

Engaging with land use and regulatory agencies on proposed policy, legislation, and projects that may impact groundwater remains a key strategy for protecting groundwater. For example, Valley Water tracks the progress of major contaminant release sites, interacting with regulatory agencies to promote expedited and thorough cleanup. Valley Water also engages with land use agencies on relevant projects and policies such as development, stormwater infiltration devices, septic systems, and small water systems.

Public outreach continues to be an important component of Valley Water's groundwater protection efforts. Valley Water annually celebrates Groundwater Awareness Week by highlighting groundwater on the Valley Water website and posting related social media messages. Valley Water also maintained its status as a Groundwater Guardian through a program sponsored by the non-profit National Groundwater Association. This is an annually earned designation for communities and affiliates that take voluntary, proactive steps toward groundwater protection.

To provide information on well sampling by Valley Water and local water suppliers, Valley Water prepared the 2020 Groundwater Quality Summary. This is similar to water retailer consumer confidence reports and provides basic groundwater quality information to domestic well owners who do not typically receive water from a water retailer.

Other groundwater-related public outreach conducted by Valley Water in 2020 included:

- Interaction with students through the Education Outreach program.
- Direct communication with well owners on groundwater quality, well maintenance, and treatment systems under the Domestic Well Testing and Nitrate Treatment System Rebate programs.

3. Continue to incorporate groundwater sustainability planning in Valley Water planning efforts.

This Plan recommendation focuses on continued, thoughtful water supply planning and investments. In November 2019, Valley Water completed an update to the Water Supply Master Plan 2040[2], which explains Valley Water's strategy for providing a reliable and sustainable water supply into the future. The Water Supply Master Plan 2040 informs investment decisions and provides a framework for annually monitoring the water supply strategy to ensure it will meet the water needs of Santa Clara County. Staff held multiple workshops with water retailers and stakeholders and presented information to the Board and the Board's Water Conservation and Demand Management Committee on numerous occasions. These presentations have included information on the proposed level of service goal and potential water supply investment strategies. The Valley Water investment strategy includes securing existing supplies, expanding water conservation and reuse, and optimizing the system. Projects approved by the Board for planning include advanced metering infrastructure, leak repair incentives, expansion of Valley Water's graywater program, a model water-efficient ordinance for new developments,

[2] Santa Clara Valley Water District, Water Supply Master Plan 2040 is available at: https://www.valleywater.org/sites/default/files/Water%20Supply%20Master%20Plan%202040_11.01.2019_v2.pdf

decentralized stormwater capture (e.g., incentives for rain barrels, cisterns, and rain gardens), and centralized stormwater capture (e.g., flooding of agricultural lands), 24 thousand acre-feet of potable reuse, the Delta Conveyance Project, expanding Pacheco Reservoir, and the Transfer-Bethany Pipeline. Details about each of these projects can be found in Appendix H of the Water Supply Master Plan 2040.

Groundwater sustainability also remains an important factor during the planning and implementation of multi-benefit projects under Valley Water's One Water Plan.[3] The Sustainable Groundwater and Water Quality objectives of the One Water Plan align with the Plan outcome measures and the process to identify individual projects on the watershed scale (e.g., Coyote Watershed) accounts for groundwater conditions and sustainability.

To support managed response to climate change, Valley Water Board of Directors adopted the Climate Change Action Plan (CCAP) on July 13, 2021[4]. The CCAP is Valley Water's guide to addressing climate change in its mission areas of water supply, flood protection, and ecosystem stewardship. The plan builds upon Valley Water's existing climate change efforts, such as reduction of Valley Water's greenhouse gas emissions and commitment to carbon neutrality, and adaption of operations to the changing climate.

4. Maintain adequate monitoring programs and modeling tools.

This Plan recommendation focuses on improving monitoring networks by identifying and addressing gaps, redundancies, and access issues; identifying and implementing improvements to the numerical groundwater flow models; and improving Valley Water's understanding of surface water/groundwater interaction and groundwater dependent ecosystems (GDEs).

Valley Water continues to offer free basic well testing for domestic well owners to supplement regional groundwater quality monitoring, which emphasizes the use of consistent wells. Through this voluntary program, Valley Water obtains valuable data on nitrate and other contaminants while providing important water quality data to about 200 private well owners each year. Valley Water is evaluating the recycled water and recharge water quality monitoring networks to ensure they meet monitoring objectives in terms of frequency, locations, and constituents analyzed. Monthly Water Tracker[5] and groundwater condition reports[6] help keep stakeholders informed about current groundwater conditions including groundwater pumping, recharge, and water levels.

Valley Water uses three calibrated groundwater flow models – one for each groundwater management area (Santa Clara Plain, Coyote Valley, and the Llagas Subbasin). These models are used to evaluate groundwater storage and levels to inform operational decisions and long-term planning efforts. Staff is assessing each model to identify related improvements or enhancements that may be needed or desired to improve the use of these tools.

[3] https://onewaterplan.wordpress.com/
[4] https://www.valleywater.org/your-water/water-supply-planning/climate-change-action-plan
[5] https://www.valleywater.org/your-water/water-supply-planning/monthly-water-tracker
[6] https://www.valleywater.org/your-water/groundwater/groundwater-monitoring

Regarding surface water/groundwater interaction, Valley Water staff has begun to evaluate available data for stream gauging and groundwater levels, and whether existing wells adjacent to creeks may be useful in collecting additional data. Valley Water will continue to explore the complex and dynamic interaction between surface water and groundwater and will engage interested stakeholders. A thorough discussion of surface water/groundwater interaction is included in Valley Water's 2021 GWMP.

5. Continue and enhance groundwater management partnerships with water retailers and land use agencies.

The Plan recommendation focuses on continued collaboration and strong partnerships with water retailers and land use agencies. Valley Water continues to interact regularly with water retailers through quarterly Water Retailer meetings, including the Groundwater Subcommittee. In addition to these regular meetings, Valley Water and water retailers collaborate on various issues that arise regarding groundwater, treated water, wells, and water measurement.

Valley Water also continues to coordinate with local land use agencies on General Plans, water supply assessments, Urban Water Management Plans, stormwater management, and various individual land use projects. Land use decisions fall under the authority of the local cities and the County of Santa Clara. Valley Water reviews land use and development plans related to Valley Water facilities and watercourses under Valley Water jurisdiction and provides technical review for other land use proposals as requested by the local agency. When provided by land use agencies, water supply assessments for new developments are also reviewed and evaluated in the context of Valley Water's long-term water supply plans. For all reviews, Valley Water's groundwater-related comments focus on potential impacts to groundwater quality and sustainability.

6. Evaluate the potential new authorities provided by SGMA.

The Santa Clara Valley Water District Act provides broad authorities, but there are additional authorities under SGMA including the ability to regulate pumping or impose various types of fees. The Plan recommendation focused on the evaluation of these new SGMA authorities in cooperation with water retailers and other interested stakeholders to consider what conditions might necessitate their implementation to sustainably manage groundwater into the future.

As first described in the WY 2017 Annual SGMA Report submitted to DWR, Valley Water has explored new SGMA authorities with interested stakeholders through the Board's Water Conservation and Demand Management Committee (Committee). Nine publicly noticed Committee meetings between December 2016 and December 2017 provided a transparent forum for discussion with interested stakeholders on how and when these authorities might be used.

The potential regulation of pumping or well construction is a complex and controversial topic, which was discussed extensively through Committee meetings. Existing groundwater management programs and strong partnerships with large pumpers are expected to result in continued sustainable conditions and are the preferred way to address future challenges. However, pumping regulation may be needed in the future to address undesirable results. The primary SGMA-related work product from the Committee meetings was a process that describes

the fundamental approach to respond to potential worsening basin conditions. This includes the steps that would be taken prior to implementing SGMA authorities to regulate groundwater pumping, with a focus on providing some certainty on the process, while avoiding prescriptive requirements that may not be effective in addressing a future issue. This process was memorialized via resolution no. 18-04 adopted by Valley Water Board on February 27, 2018. This resolution was included as Attachment 2 in the WY 2018 Annual SGMA report to DWR.

Valley Water also explored the potential to implement a fixed charge as a component of groundwater production charges, which are currently volumetric charges. This could potentially reduce volatility in rates and revenues based on changes in water use. Valley Water engaged a consultant to develop a fixed charge proposal and assist with implementation. However, major water retailers expressed significant concerns, including redundancy with other charges or charge adjustment mechanisms, equity in applying the charge to all well users, and potential cost recovery impacts to retailers regulated by the California Public Utilities Commission. After discussing these concerns with the Committee and the full Board, Valley Water is unlikely to further pursue a fixed charge at this time.

6.3 Status of Sustainable Groundwater Management Act Compliance

In December 2016, Valley Water submitted the Plan (for the Santa Clara and Llagas Subbasins) to DWR as an Alternative to a Groundwater Sustainability Plan (GSP). In July 2019, DWR issued an assessment, finding the Valley Water Plan satisfies the objectives of SGMA and is an acceptable Alternative. Valley Water will be required to submit an updated Plan every five years. The first five-year updated was approved by Valley Water Board in November 2021 and was submitted to DWR before the statutory deadline of January 1, 2022. The 2021 Groundwater Management Plan updates and expands on technical information in the 2016 Plan and addressed related recommendations from DWR and basin stakeholders. Basin management goals, strategies, programs, and outcome measures in the 2021 Plan are very similar to the 2016 Plan because they have been effective in ensuring sustainable conditions. The 2021 Annual Groundwater Report will reference and address the 2021 Groundwater Management Plan, including updated outcome measures.

Once an Alternative or GSP is submitted, SGMA requires that specific information on groundwater use, levels, and storage be reported annually by April 1 for the previous water year. In April 2022, Valley Water submitted the fifth annual report required by SGMA (Appendix E). Because most Valley Water planning efforts are based on the calendar year, this Annual Groundwater Report presents some of the same information based on the calendar year. It also provides more detailed information on groundwater conditions than the SGMA annual report, particularly regarding groundwater quality.

Valley Water is also the GSA for the small portions of the North San Benito Subbasin within Santa Clara County.[7] As such, Valley Water has supported efforts led by the San Benito County Water District[8] to develop a GSP for the entire subbasin. Valley Water's support included serving on the Technical Advisory Committee, sharing relevant data, and other coordination as needed. The North

[7] A basin boundary modification was approved by DWR in 2019 to consolidate four subbasins primarily located in San Benito County. These include the Hollister and San Juan Bautista Area subbasins, which extend into Santa Clara County.
[8] The GSA for the portions of the North San Benito Subbasin located in San Benito County.

San Benito GSP was adopted by the SBCWD Board of Directors on November 17, 2021 and by the Valley Water Board of Directors on December 14, 2021. The North San Benito GSP was submitted to DWR for review and approval before the statutory deadline of January 31, 2022 and the first annual report was submitted to DWR prior to the April 1 deadline.

Continued groundwater sustainability is central to the Valley Water mission to provide Silicon Valley safe, clean water for a healthy life, environment, and economy. As such, Valley Water will continue to "manage groundwater to ensure sustainable supplies and avoid land subsidence" and "aggressively protect groundwater from the threat of contamination " in accordance with Board Ends policy. Valley Water's approach to groundwater management has evolved over many decades to address numerous challenges, and this adaptive approach will help ensure continued sustainability.

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Appendices

APPENDIX A
2020 Subsidence Data Analysis

TECHNICAL MEMORANDUM

2020 SUBSIDENCE DATA ANALYSIS

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June 2021

EXECUTIVE SUMMARY

This technical memo presents land subsidence data analysis for calendar year 2020. Throughout the first two thirds of the 20th Century, land subsidence occurred in the Santa Clara Plain in northern Santa Clara County mainly due to groundwater overdraft causing declining groundwater elevations and pressures. Permanent (inelastic) subsidence was essentially halted in the early 1970s through Valley Water's conjunctive management programs and investments (Valley Water, 2019). Monitoring continues and is critical to fulfilling Valley Water's mission of minimizing land subsidence and saltwater intrusion (Board Ends Policy 2.2.1 and 2.2.2). Monitoring provides data to evaluate current conditions and for early detection of the potential resumption of permanent subsidence. Annually, Valley Water analyzes land subsidence monitoring data, evaluates subsidence conditions, and recommends improvements to the subsidence monitoring network. Data collected mainly from 2010 to 2020 is used in this analysis.

2020 annual precipitation was 5.19 inches (NOAA San Jose Station: GHCND:USW00023293), in comparison to the average annual precipitation of 14.50 inches in the Santa Clara Plain. The annual estimated groundwater pumping in 2020 was 81,800 acre-feet (AF) in the Santa Clara Plain. 2020 total estimated groundwater recharge was 69,900 AF, of which 44,000 AF was managed recharge and 25,900 AF was natural recharge. Since pumping exceeded total recharge, the overall groundwater storage decreased in the Santa Clara Plain in 2020.

The data measured in 2020 through the Valley Water's subsidence monitoring network show the following:

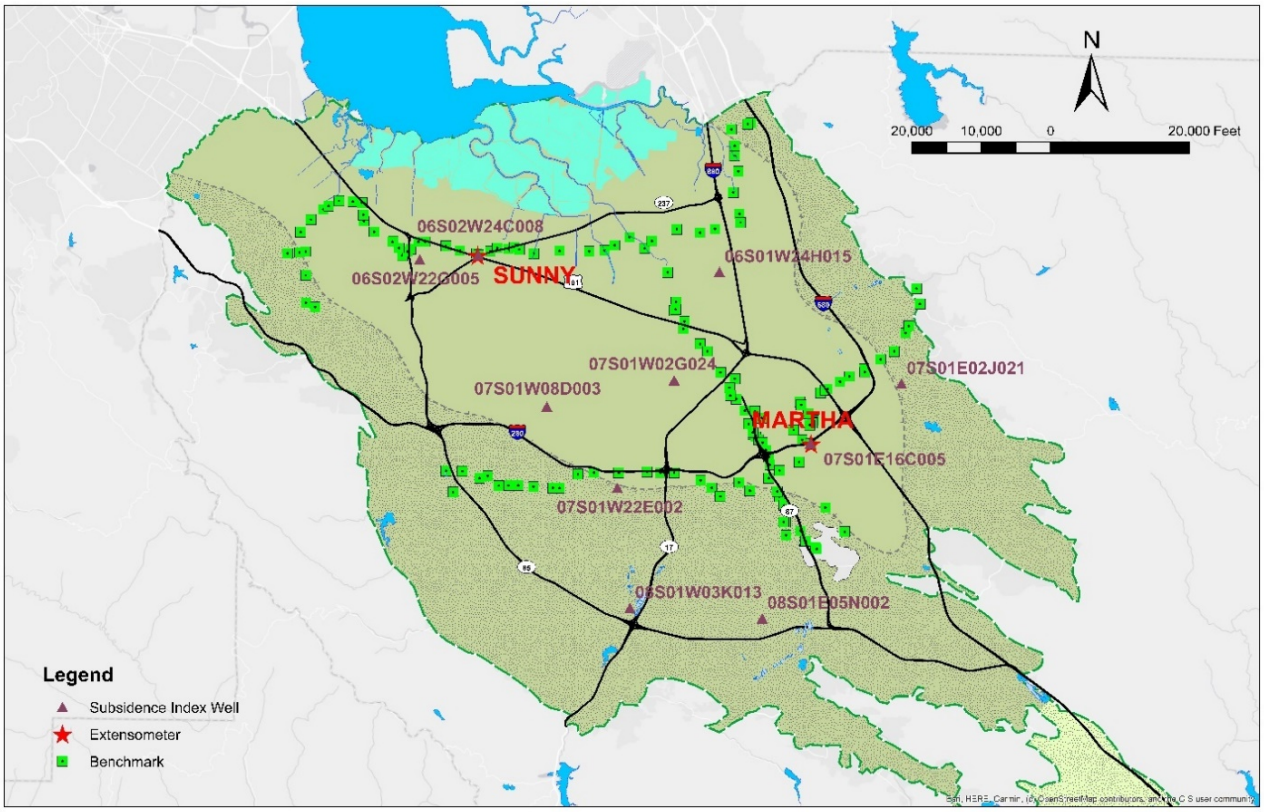
- 2020 annual average of groundwater elevations were lower than 2019 level. The groundwater elevations were, however, above subsidence thresholds at all ten index wells for the entire year.
- Aquifer compaction (subsidence) was measured at the Valley Water's two extensometer sites in 2020. The average annual subsidence rate over the last 11 years (2010-2020) at the San Jose (Martha) and Sunnyvale (Sunny) sites is -0.003 feet/year (aquifer expansion), which meets the Valley Water's established tolerable subsidence rate of not more than 0.01 feet/year.
- The land surface elevation change from 2020 to 2019 at the survey benchmarks indicated compaction throughout much of the center of the Santa Clara Plain but uplift along the margins. Over the last 11 years (2010-2020), the average annual change in land surface elevations was slightly greater than zero (uplift) at all survey benchmarks.

The analysis of the data collected through Valley Water's subsidence monitoring network indicates a low risk of permanent land subsidence in 2020, although the risk increased from 2019. Monitoring of the subsidence network will continue as it is needed to detect early signs of permanent land subsidence and to ensure a sustainable groundwater supply.

BACKGROUND

The Santa Clara Plain is a groundwater management area occupying the northwestern and largest part of the Santa Clara Subbasin (Figure 1). The Santa Clara Plain extends from Santa Clara County's northern boundary to approximately Metcalf Road in the Coyote Valley and is bounded on the west by the Santa Cruz Mountains and the east by the Diablo Range. Land subsidence has caused serious problems in the Santa Clara Plain prior to about the 1970s, including up to 14 feet of permanent subsidence in downtown San Jose and more than a foot of permanent subsidence over the surrounding hundred square miles.

Figure 1. Valley Water subsidence monitoring network.



Ongoing monitoring provides data for current land subsidence evaluation and early detection of potential permanent subsidence. The Valley Water land subsidence monitoring network (Figure 1) includes:

- Two extensometers: one in Sunnyvale (Sunny) and one in San Jose (Martha), both are monitored continuously by telemetry systems;
- Approximately 140 elevation benchmarks along three Cross Valley Level Circuits (CVLCs) are surveyed in the fall of every year; and
- Ten subsidence index wells throughout the Santa Clara Plain with groundwater elevations monitored at least monthly.

EVALUATION

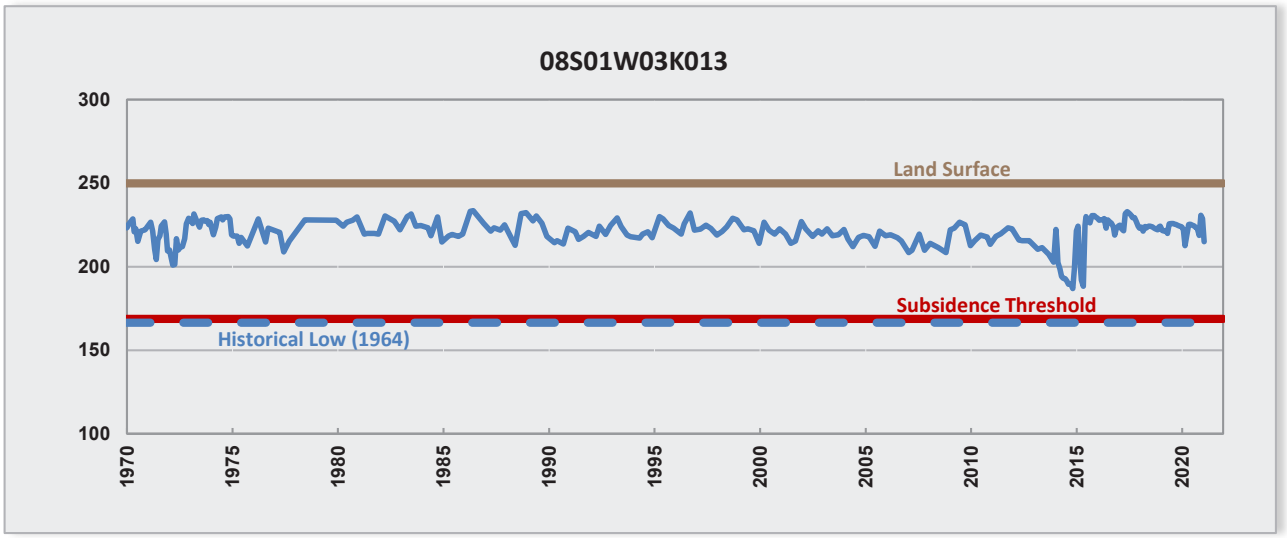
Figure 1 shows a map of the Valley Water subsidence monitoring network in the Santa Clara Plain. Two extensometers are in the confined area of the Santa Clara Plain. Benchmarks are grouped into three CVLCs: Guadalupe (northwest-trending circuit along the axis of the valley), Los Altos (west-east trending circuit to the north), and Alum Rock circuit (west-east trending circuit to the south). The ten subsidence index wells are located throughout the Santa Clara Plain.

Groundwater elevation analysis

Groundwater elevation monitoring is an integral part of the land subsidence monitoring program because the decrease in water elevation is the driving force of land subsidence in the Santa Clara Plain. The current frequency of groundwater elevation monitoring at subsidence index wells varies from daily

to monthly. Water elevation hydrographs at the ten index wells are presented in Figure 2, along with land surface elevations, historical low water levels, and subsidence groundwater elevation thresholds determined for each well (GEOSCIENCE, 1991). The North American Vertical Datum of 1988 (NAVD88) is used for the groundwater elevation values in this document.

Figure 2. Measured groundwater elevation at subsidence index wells (Feet, NAVD88) (Note – hydrographs contain primarily static water level readings and some pumping water level readings.)



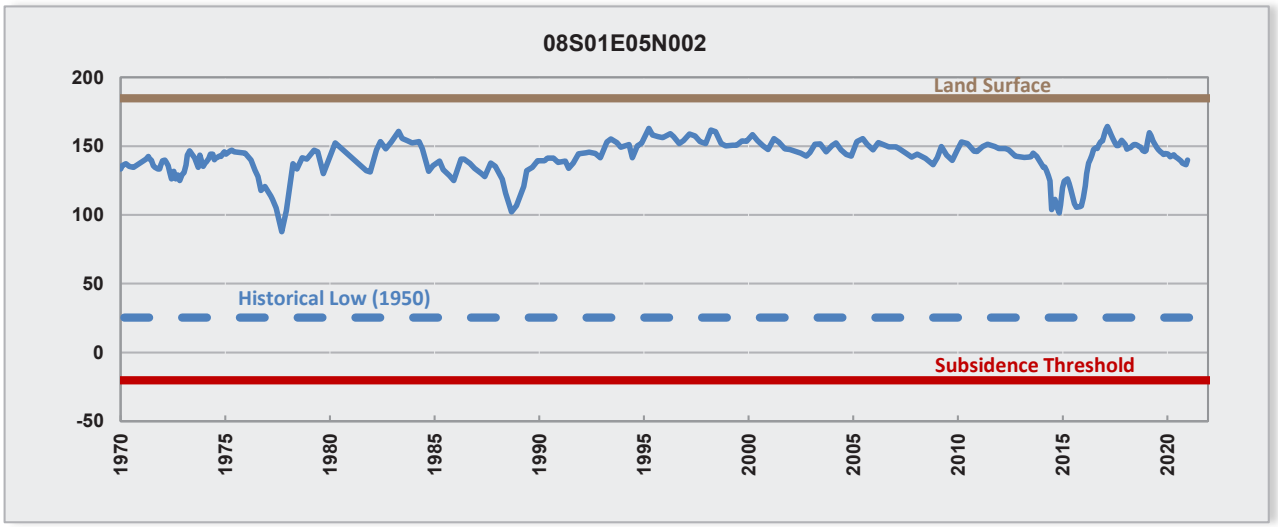
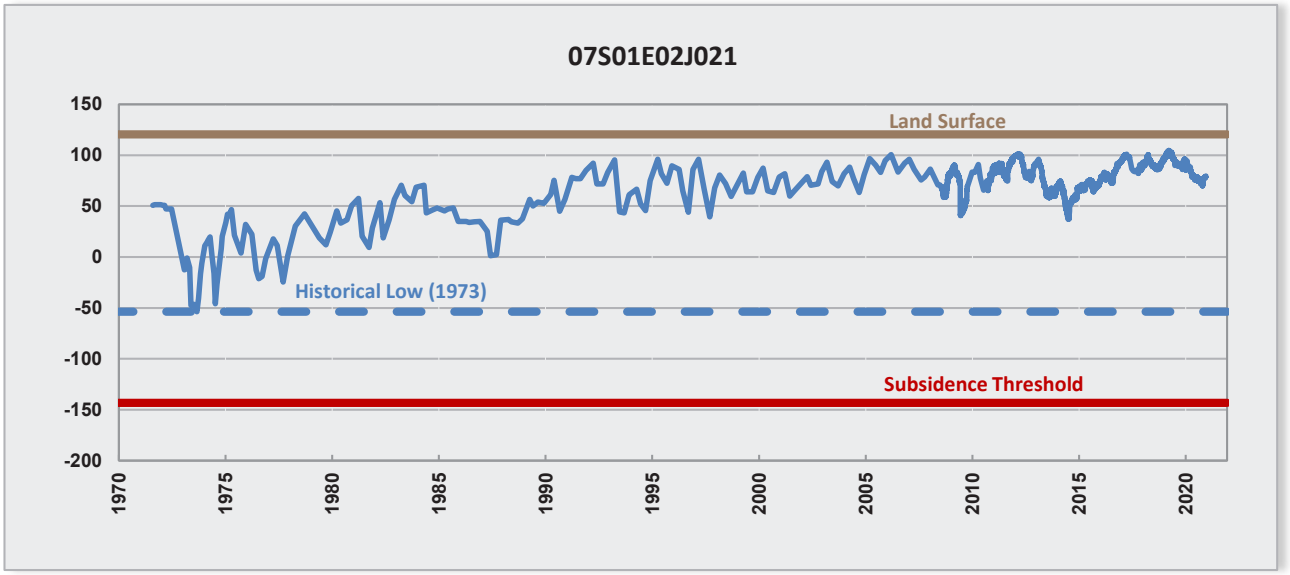
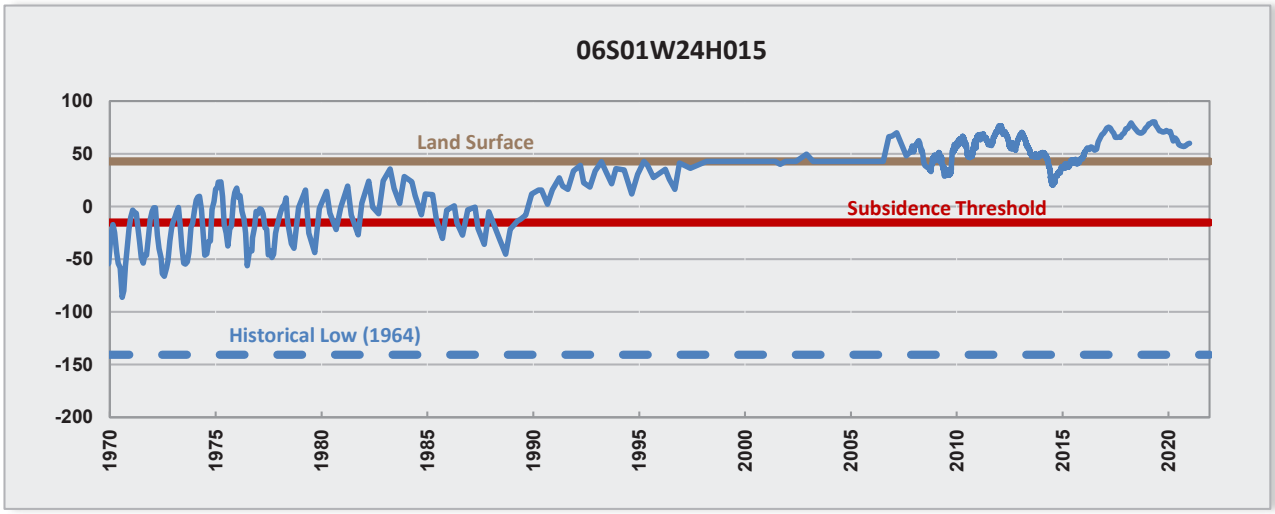
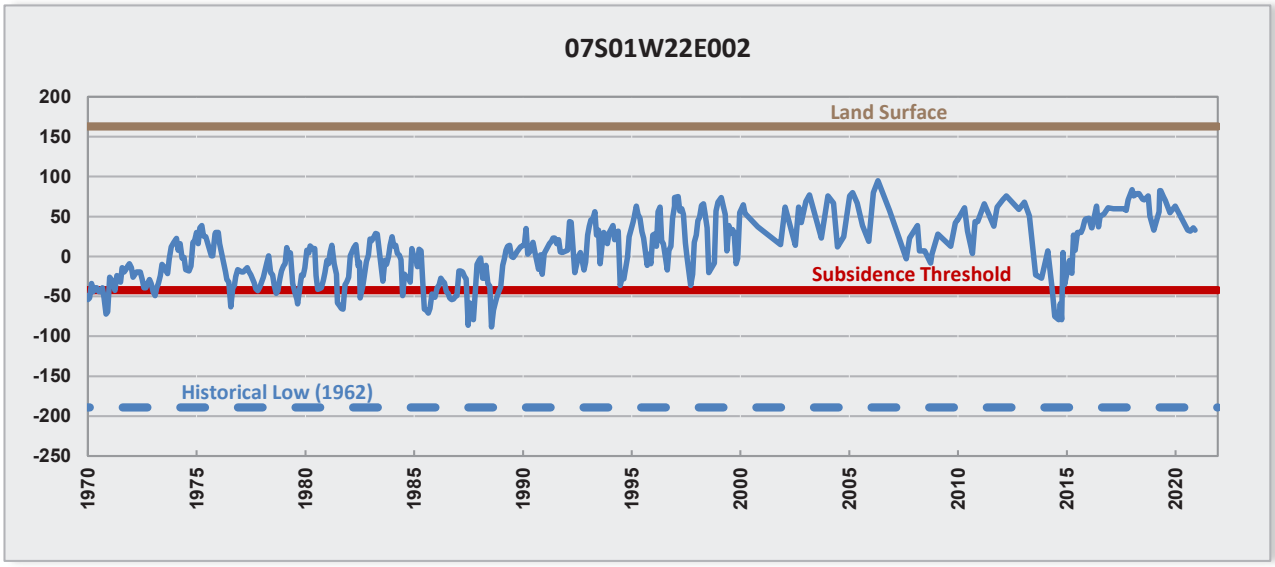


Figure 2. Continued.







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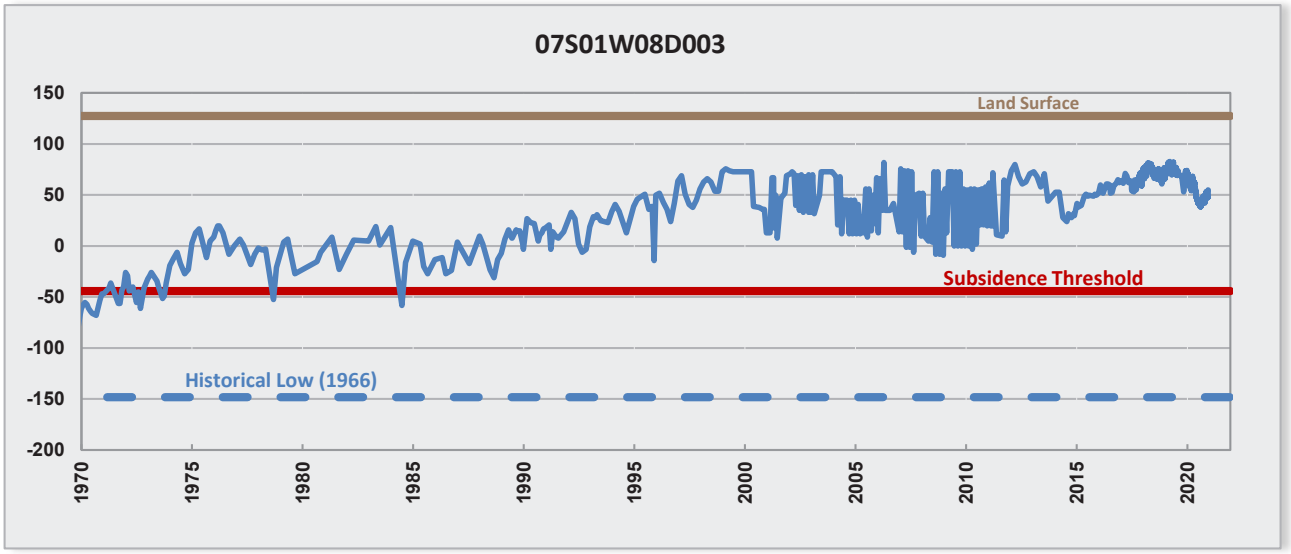
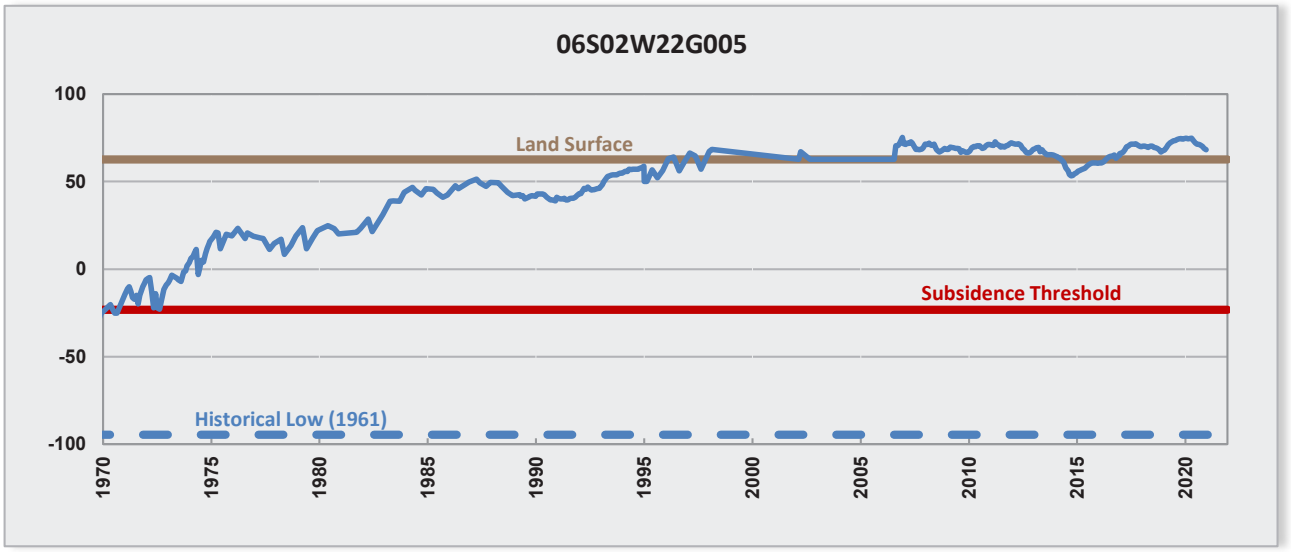




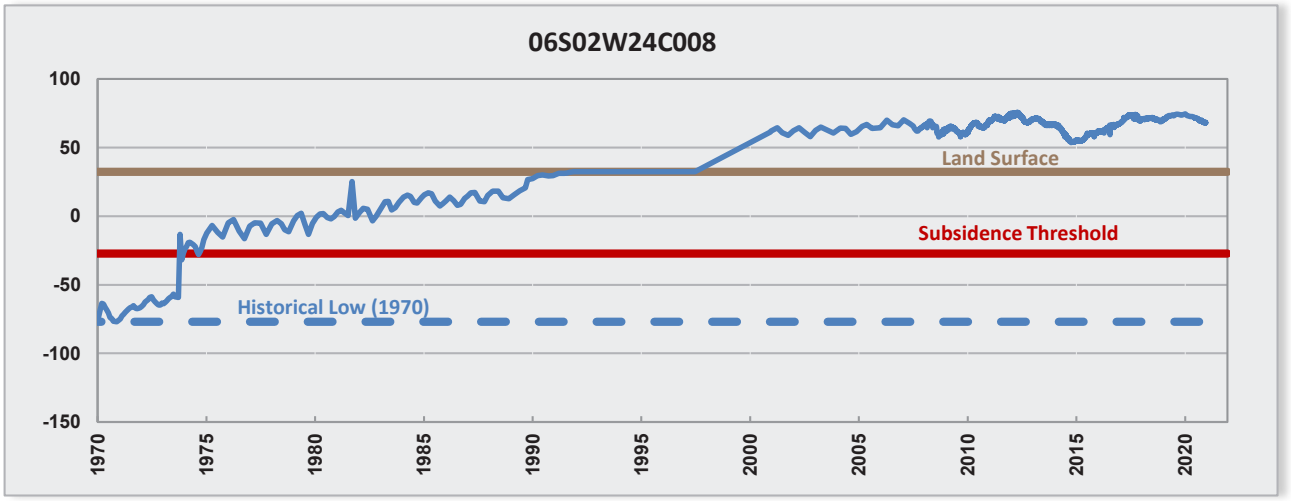
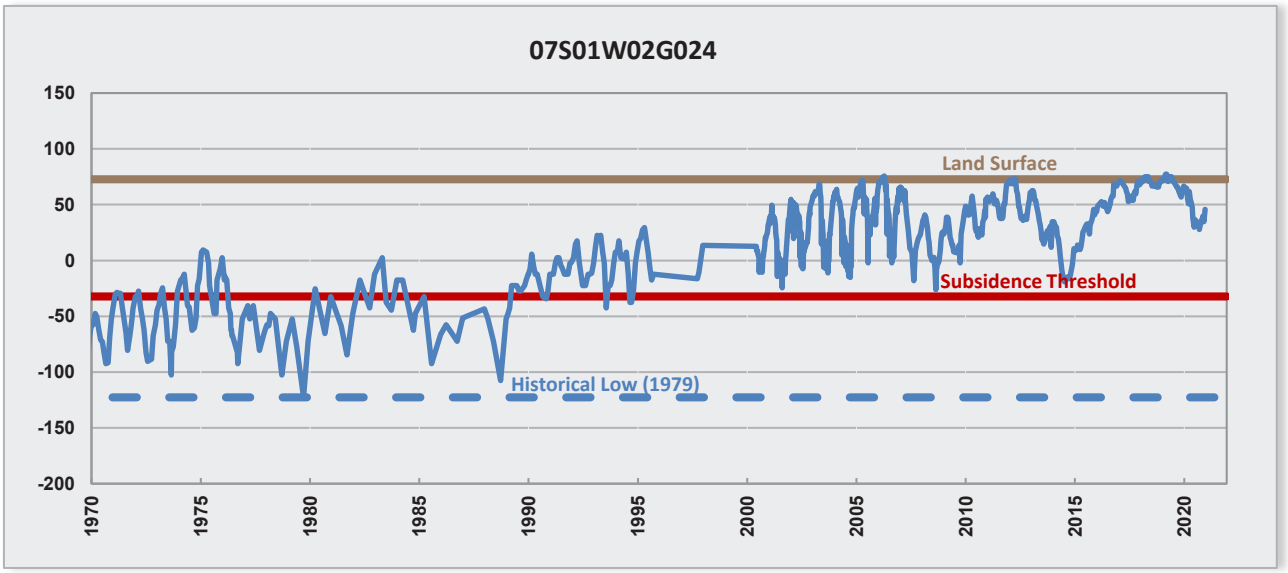
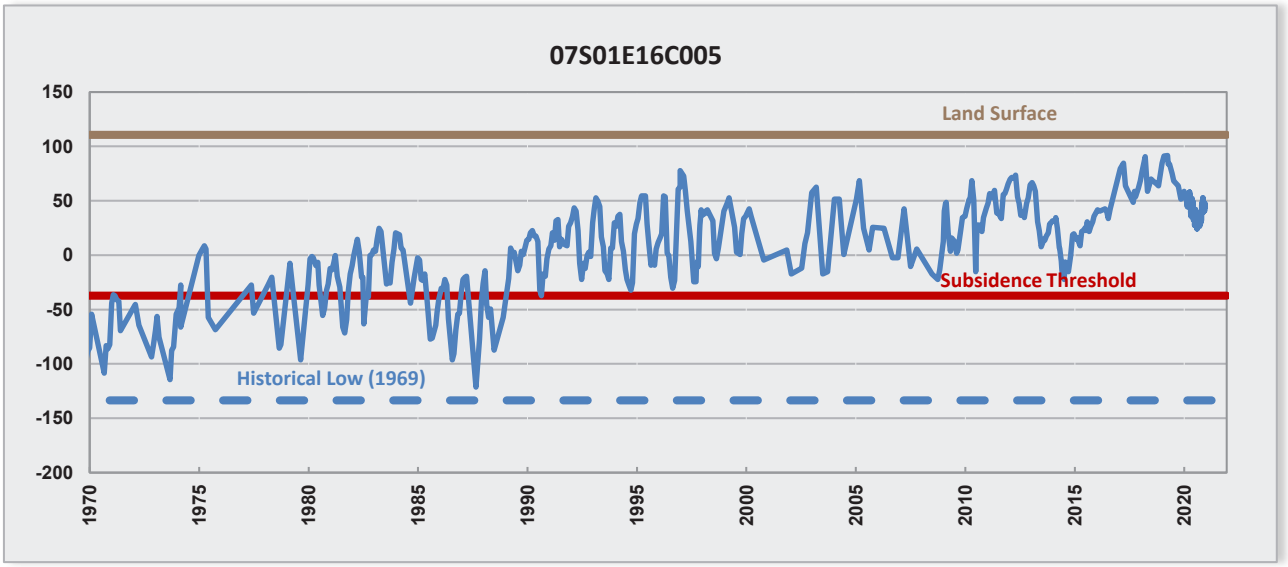


Figure 2. Continued.





Notes on hydrograph for 07S01E16C005: In May 2021, the PRESS subsidence index well #10 (07S01E16C006) was replaced with 07S01E16C005 for all subsequent subsidence monitoring and analysis. The replacement well (07S01E16C005) is also located at the same 12th Street Station well field but has several advantages over the existing 07S01E16C006 well, including well access by Valley Water staff, an increased (daily) monitoring frequency, and accessibility with telemetry. Additional details about the rationale for replacing the well is documented in the memorandum by Liu et al. (2021).

A subsidence threshold is a recommended groundwater elevation; maintaining groundwater at elevations near or below the threshold for extended periods of time increases the risk of subsidence resumption and potential damage to facilities and infrastructures. Historically, land subsidence was observed mainly in the confined area of the Santa Clara Plain. Accordingly, most index wells (eight out of ten) are in or near the confined area (Figure 1). Valley Water's groundwater management goal is to

maintain groundwater elevations in the Santa Clara Plain above subsidence thresholds to minimize the risk of resuming permanent land subsidence.

Historical low groundwater elevations at most wells in Santa Clara Plain were observed in the 1960s and 1970s. Since then, the groundwater elevations have been generally in recovery due to the importation of surface water from the Delta and related increased managed recharge and/or reduced groundwater pumping. The annual precipitation from 2017 to 2019 was close to or above the normal after the last drought (from 2012 to 2016). The average groundwater elevations rose in 2016 and 2017 and reached near historic highs in 2018 and 2019 at most subsidence index wells (Figure 2). However, the annual precipitation in 2020 was only 5.19 inches in San Jose, which is well below the annual average (14.50 inches) and made 2020 a dry year. The 2020 annual pumping of 81,800 AF (thousand acre-feet) was higher than the annual total recharge of 69,900 AF in the Santa Clara Plain. As results, both the 2020 average and end-of-year groundwater elevations were generally lower than that of 2019 throughout the Santa Clara Plain (Figure 2). The 2020 average groundwater elevation among ten subsidence index wells was about 14 feet lower than 2019 (ranging from 0 to 30 feet lower) and about 105 feet higher than land subsidence thresholds (ranging from 54 to 224 feet higher).

It is critical to manage the Santa Clara Plain groundwater basin in a manner that maintains a groundwater gradient towards the San Francisco Bay to prevent seawater from entering the groundwater aquifer. There are three index wells along the bay front: 06S02W22G005, 06S02W24C008 and 06S01W24H015 (Figure 2). In 2020, all three bay front index wells remain under flowing artesian conditions (i.e., water levels rise above land surface), which reduces the risk of seawater intrusion.

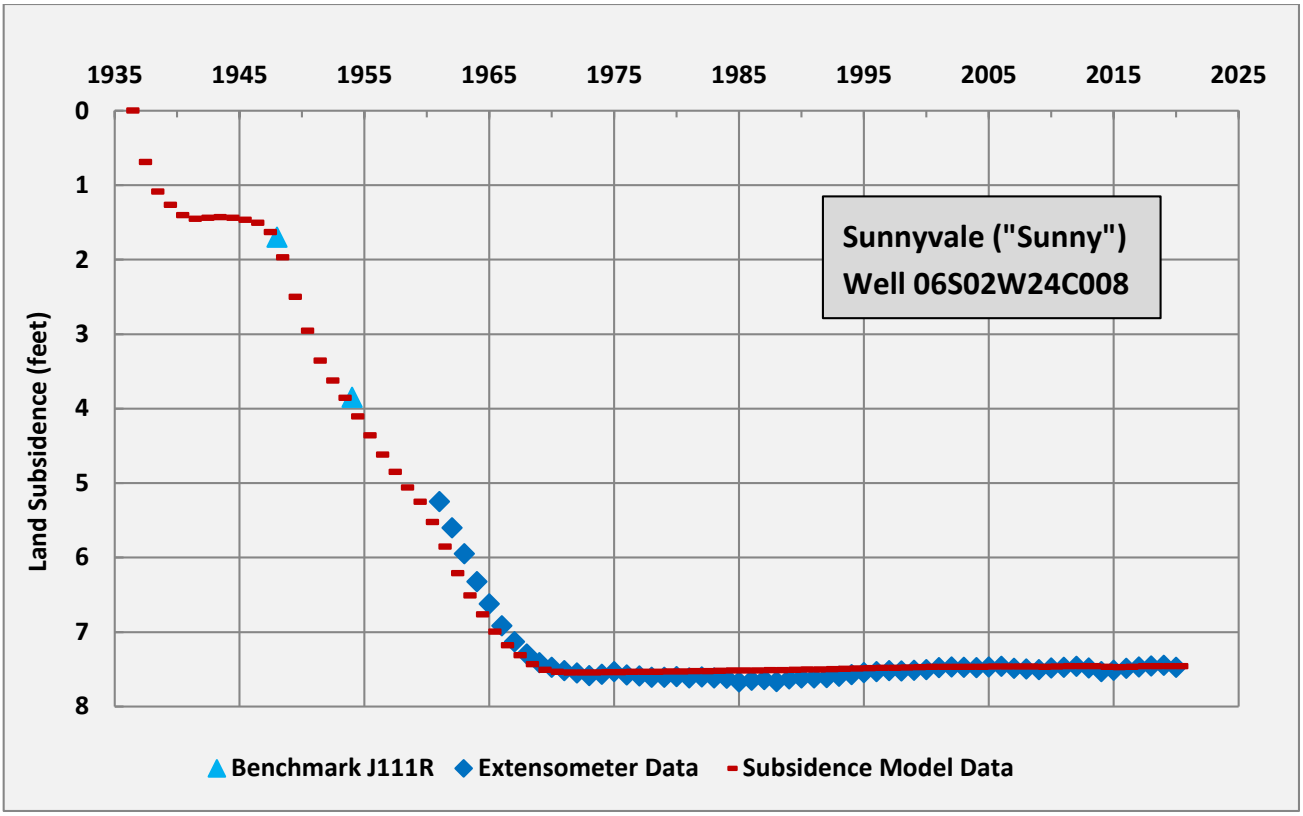
In summary, 2020 groundwater elevations at the ten subsidence index wells were maintained well above subsidence thresholds, although the 2020 groundwater elevations were lower than the historic high elevations in 2019. Measured groundwater elevations indicate a low risk of both land subsidence resumption and seawater intrusion in 2020.

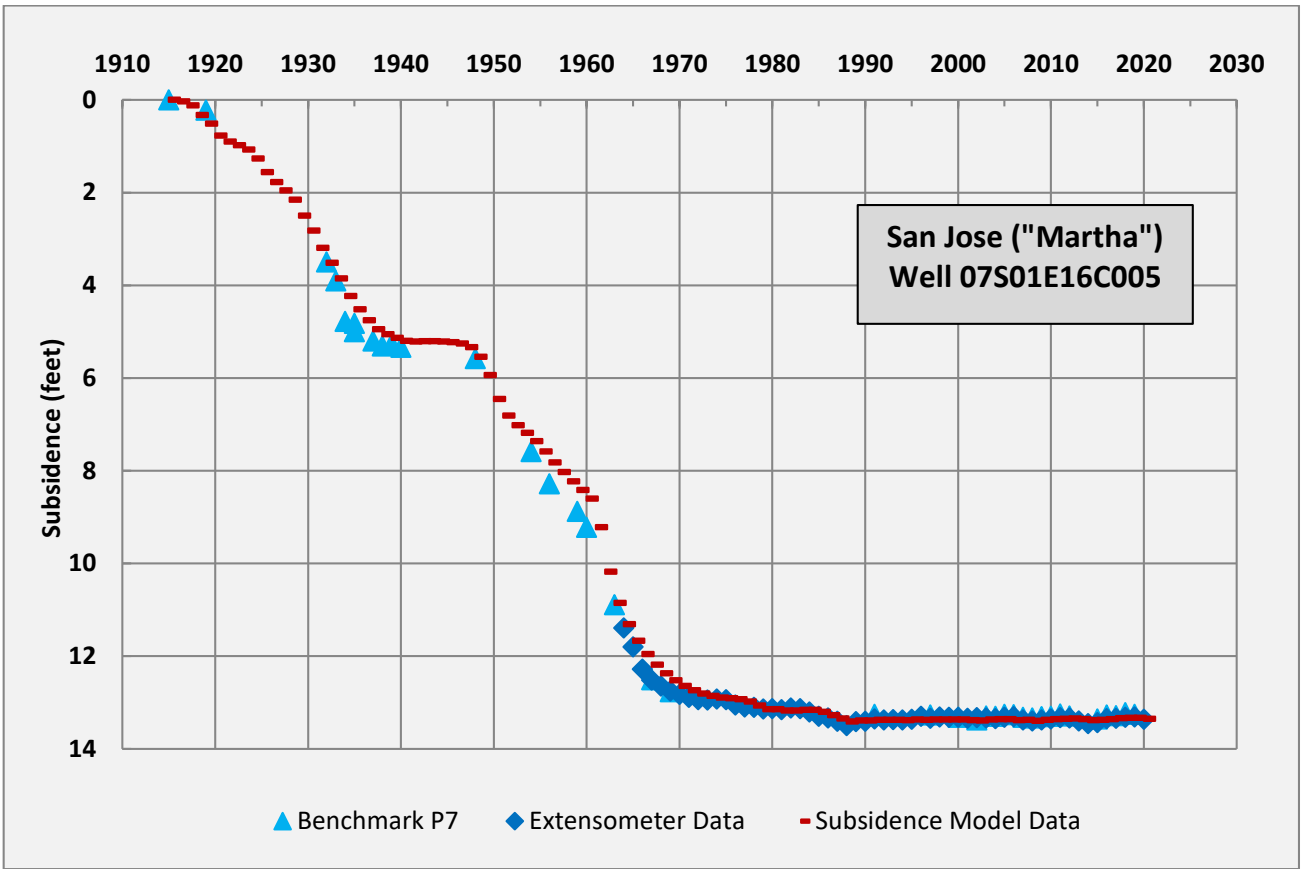
Extensometer data analysis

Daily aquifer compaction/expansion data measured at two extensometers and depth to water (DTW) measured at or near the extensometers were used for this analysis. An extensometer is a device used to continuously monitor aquifer compaction (subsidence) and expansion (uplift). The extensometers were installed in the early 1960s in Sunnyvale (Sunny) and San Jose (Martha) to measure the compaction or expansion of the first 1,000 feet of the aquifer system. The extensometer sites were selected in areas with high land subsidence between the 1930s and 1960s. These areas were also groundwater pumping centers during that period. Valley Water's goal for the average value of subsidence measured at these two sites over the last 11 years is not to exceed a tolerable subsidence rate of 0.01 feet/year (GEOSCIENCE, 1991).

Long- term data: Figure 3 shows cumulative compaction measured at the extensometers for the period of record supplemented with nearby benchmark data, along with numerical model simulated results. Land subsidence occurred mostly prior to 1970 and has been negligible over the last several decades (Figure 3). There is close correlation between Valley Water's land subsidence model (PRESS model) output and observed compaction (Figure 3).

Figure 3. Cumulative compaction at extensometers.

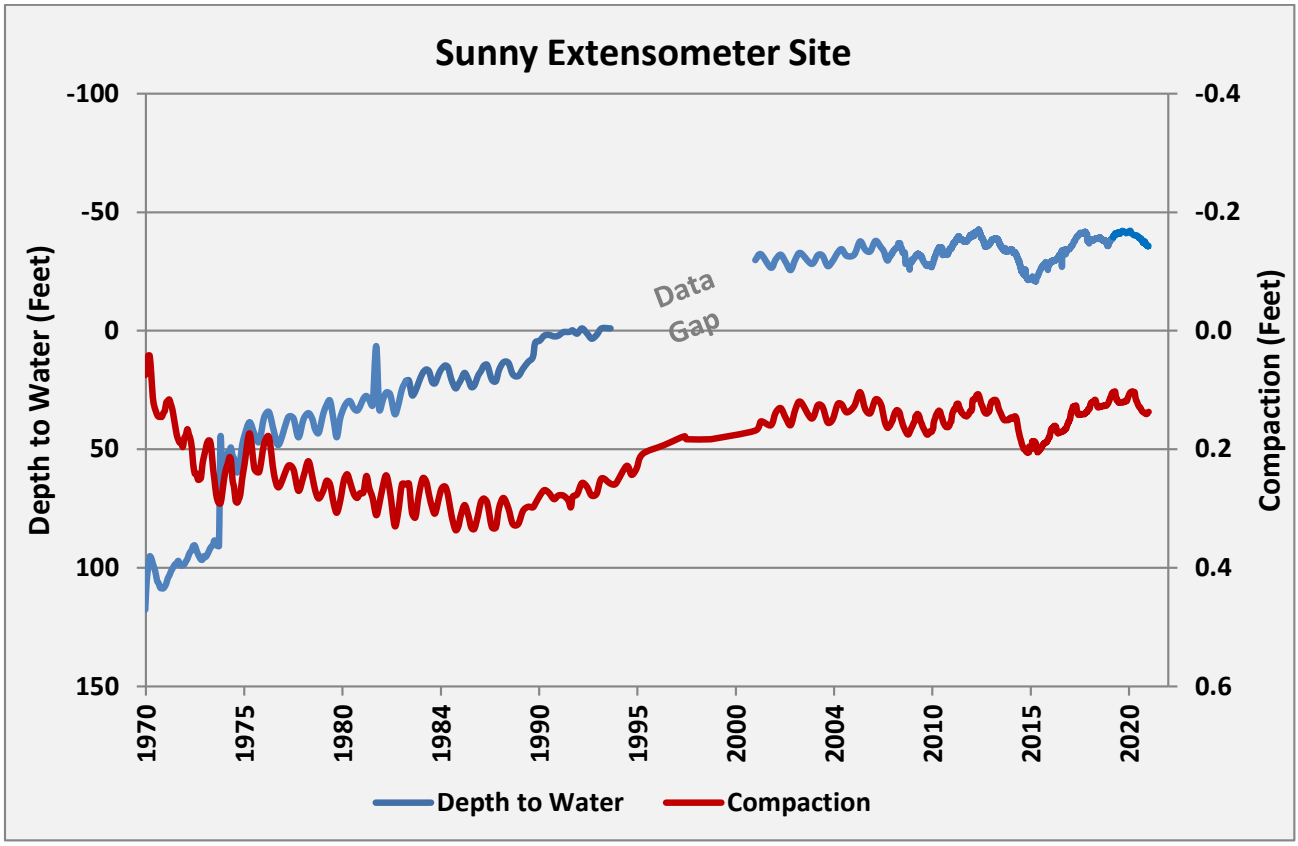


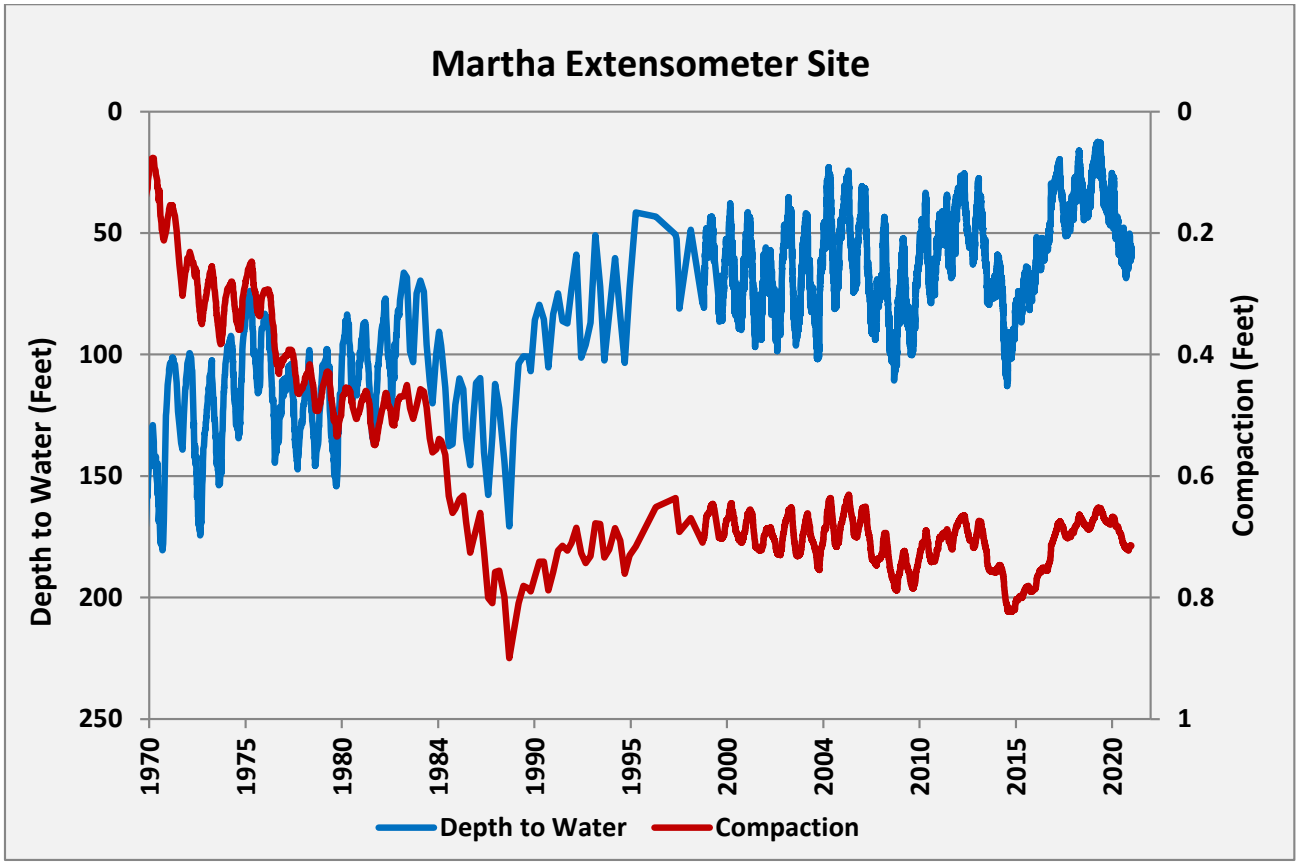


Permanent (inelastic) subsidence was essentially halted in the early 1970s in Santa Clara Plain (Figure 3). Figure 4 presents the cumulative aquifer compaction/expansion and DTW measured from 1970 to 2020 for the Sunny and Martha extensometers. In general, there was very little land subsidence at the extensometers between 1970 and 2020. During this time period, there was about 0.08 feet and 0.62 feet of compaction at the Sunny and Martha extensometer, respectively (Figure 4).

Although both extensometers recorded little subsidence between 1970 and 2020, there are some notable differences in compaction/expansion and DTW at the two sites. First, the maximum compaction from 1970 to 1988 was 0.819 feet at Martha and 23% of it was recovered between 1988 and the end of 2020. In comparison, the maximum compaction was only 0.330 feet at Sunny and 72% of it was recovered by the end of 2020 (Figure 4). Second, the groundwater elevation at Sunny has been above the land surface (negative DTW) since 1993, while the groundwater elevation at Martha has consistently been below the land surface (positive DTW) (Figure 4). Finally, the seasonal variability in water elevations at Sunny is relatively small compared to the seasonal variability in water elevations at Martha (Figure 4). The dampened seasonal signal in the water elevations at Sunny indicates pumping activities nearby have been reduced during the last forty years. The greater recovery of compaction at Sunny is attributed to relatively less pumping and associated greater artesian pressure at the Sunny site compared to Martha site from 1970 to 2020.

Figure 4. Measured depth to water and cumulative compaction at extensometers.





Current conditions: Measured extensometer data are used to evaluate current land subsidence conditions. Table 1 shows measured annual subsidence from 2010 to 2020 and the calculated 11-year average at Sunny and Martha. The 11-year average of annual subsidence rate is -0.003 feet/year, with the negative value of extensometer data indicating aquifer expansion (or uplift). This value meets the Valley Water tolerable subsidence rate goal of not exceeding 0.01 feet/year over the last 11 years. The 11-year average value reported in the 2019 Subsidence Data Analysis Technical Memorandum increased from -0.006 feet/year to -0.003 feet/year in 2020.

Table 1. Measured annual land subsidence at the Sunnyvale (Sunny) and San Jose (Martha) extensometers from 2010 to 2020.

Year	Sunny (feet/year)	Martha (feet/year)	Average at Two Sites (feet/year)
2010	-0.025	-0.024	-0.025
2011	-0.009	-0.032	-0.021
2012	-0.014	0.013	-0.001
2013	0.026	0.064	0.045
2014	0.049	0.053	0.051
2015	-0.022	-0.021	-0.022
2016	-0.025	-0.087	-0.056
2017	-0.018	-0.007	-0.013
2018	-0.013	-0.020	-0.017
2019	-0.009	-0.005	-0.007
2020	0.028	0.046	0.037
Average from 2010 – 2020	-0.003	-0.002	**-0.003**

Notes: negative values indicate aquifer expansion and positive values indicated aquifer compaction in Table 1.

Benchmark survey data analysis

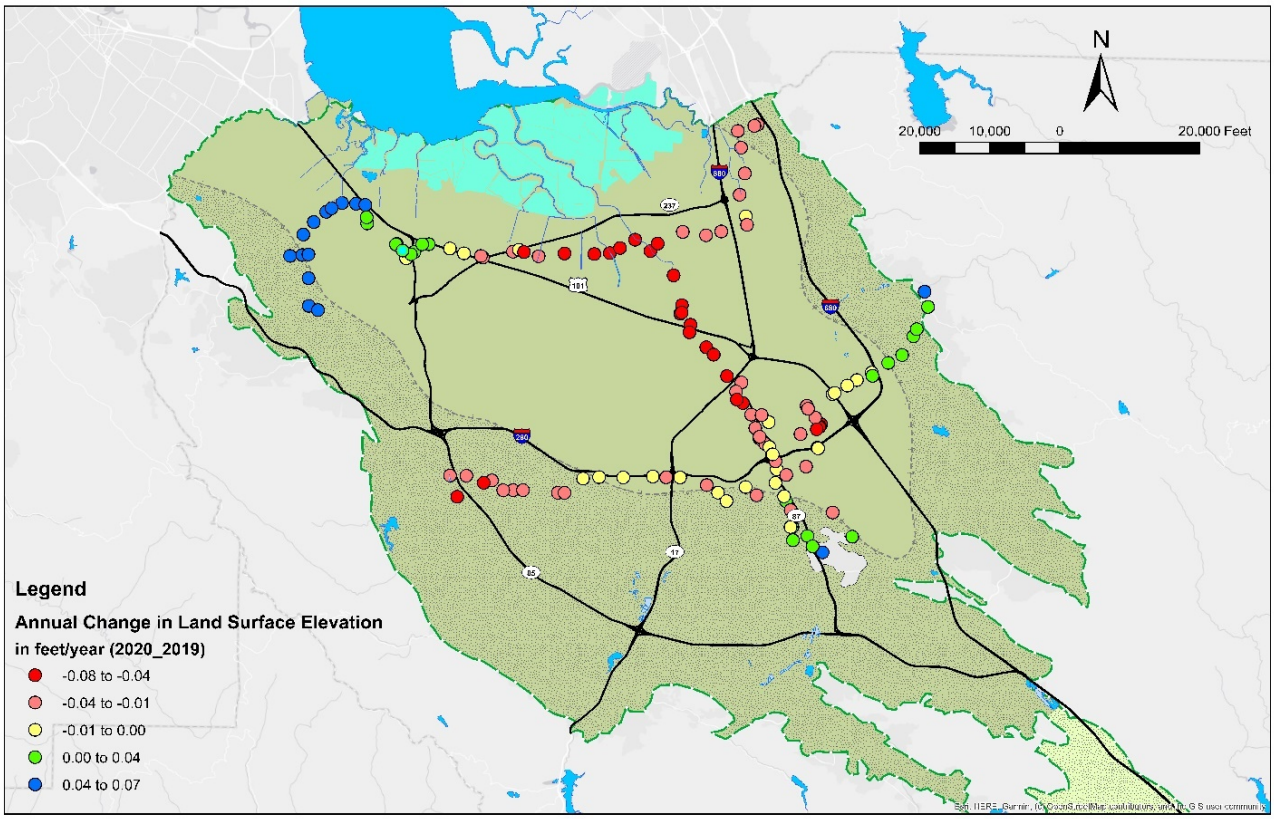
The benchmark survey data along the Los Altos, Alum Rock, and Guadalupe CVLCs are used to study spatial land subsidence conditions and annual changes throughout the Santa Clara Plain. The benchmark survey is conducted in the fall of each year. Figure 1 shows benchmark locations along the three CVLCs surveyed in 2020. Related analysis is summarized below.

Change in land surface elevation from 2019 to 2020: As discussed above, 2020 groundwater elevations were lower than 2019 elevations, which were near historically high levels throughout the Santa Clara Plain. Figure 5 shows the annual change in land surface elevation from 2019 to 2020 at benchmarks along the Los Altos, Alum Rock, and Guadalupe circuits. For benchmark survey data, a positive value indicates an increase in land surface elevation (uplift) and a negative value indicates a decrease in land surface elevation (subsidence); this is the opposite of the extensometer data.

The 2020 survey data showed a trend of negative land surface elevation changes (subsidence) from 2019 at the majority of benchmarks (Figure 5), especially in the center of the groundwater management area. However, some relatively minor uplift was observed along the western portion of the Los Altos

circuit, the eastern portion of the Alum Rock circuit, and the southern portion of the Guadalupe circuit (Figure 5).

Figure 5. Land surface elevation change at benchmarks between 2019 and 2020.



Notes: positive values indicate land surface uplift and negative values indicate land surface subsidence in Figure 5.

Table 2 summarizes the average and range of annual change of land surface elevation from 2019 to 2020. The average annual change of all 2020 benchmarks compared to 2019 is 0.00 feet/year (Table 2), which indicates no net change across all three CVLCs.

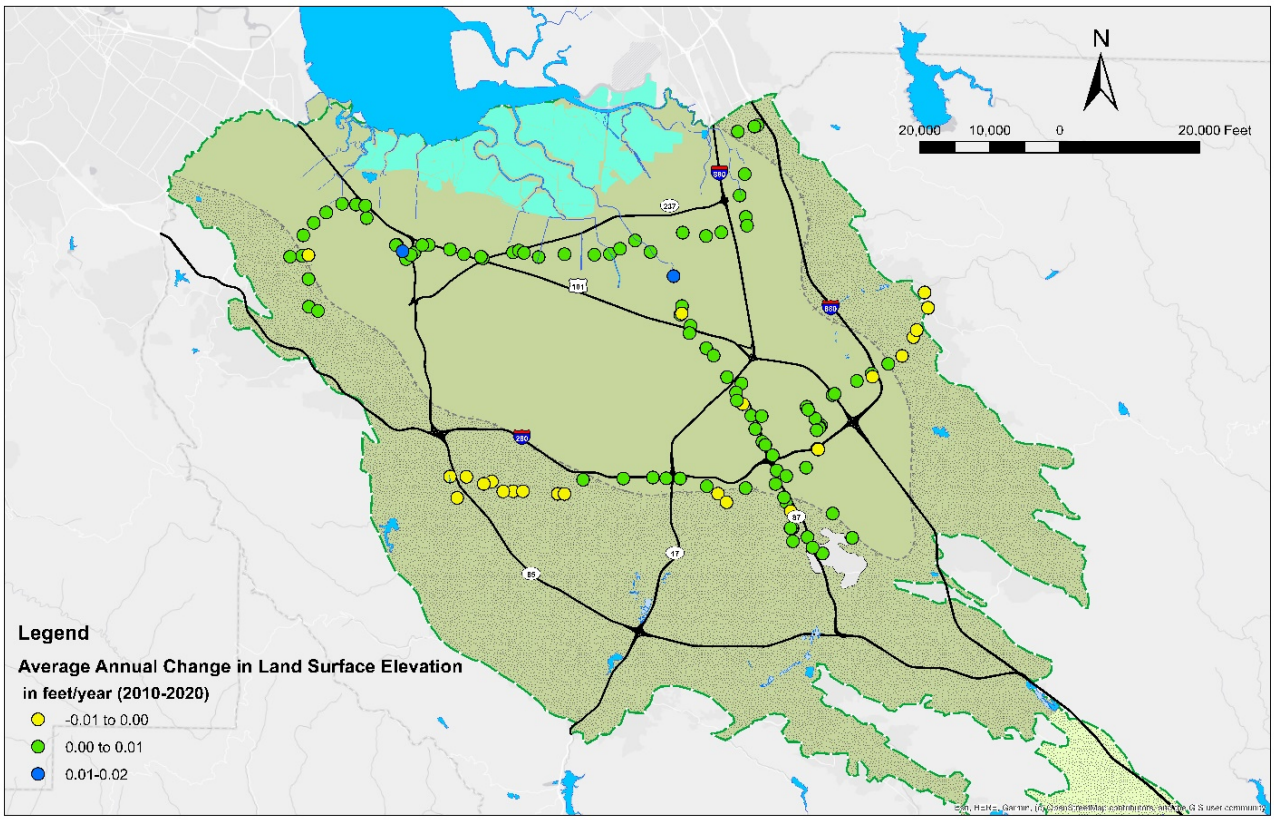
Table 2. Fall 2020 change in land surface elevation for benchmark circuits compared to Fall 2019.

Survey Circuit	Average Change (feet)	Range (feet)	Number of Benchmarks
Los Altos	0.01	-0.07 to 0.07	38
Alum Rock	0.02	-0.05 to 0.05	52
Guadalupe	-0.03	-0.08 to 0.06	50
Total	0.00	-0.08 to 0.07	140

Long-term change in land surface elevation: The average annual change of land surface elevation over the last 11 years from 2010 to 2020 at individual benchmarks is presented in Figure 6. Although land surface elevations at some benchmarks may increase or decrease at higher values in some years, none

of the benchmarks had an average annual change less than -0.01 feet/year (Figure 6), which meet the Valley Water's tolerable rate of 0.01 feet/year subsidence.

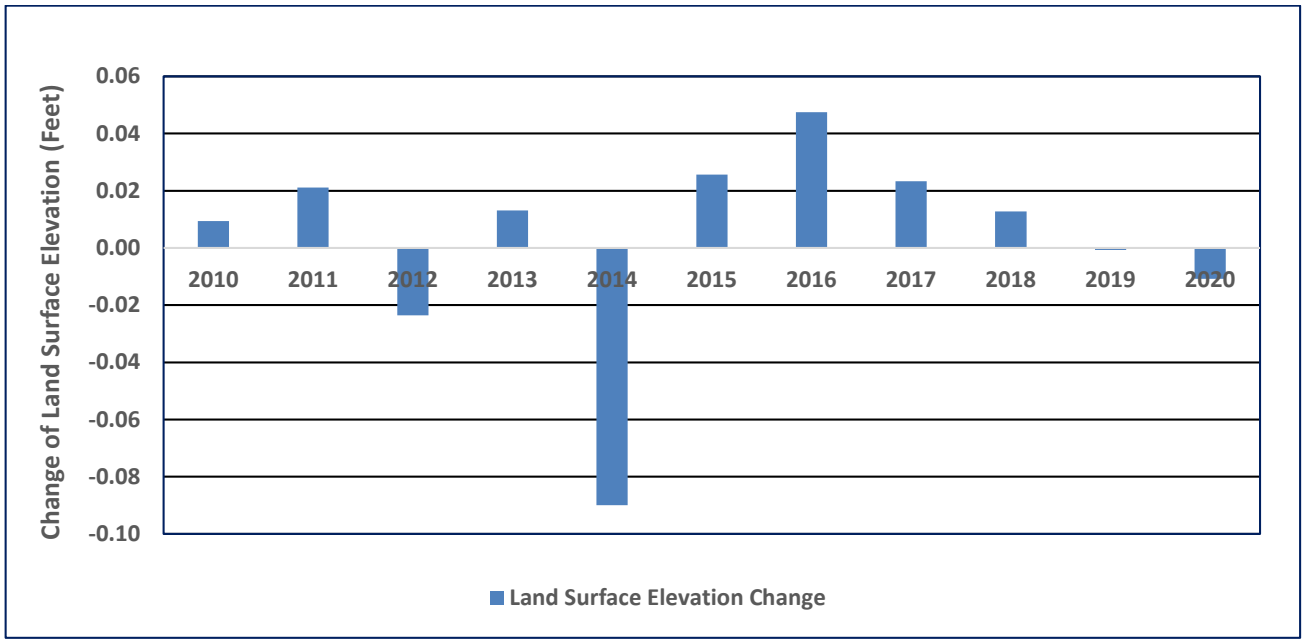
Figure 6. Average annual change in land surface elevation at benchmarks between 2010 and 2020.



Notes: positive values indicate land surface uplift and negative values indicate land surface subsidence in Figure 6.

Figure 7 shows the average annual change in land surface elevation at all benchmarks over the last 11 years from 2010 to 2020. During this 11-year period, there were seven years with positive average values (uplift) and four years with negative average values (subsidence). The highest annual average subsidence was in 2014 and highest annual average uplift was in 2016. The average annual ground surface elevation change for all benchmarks over the last eleven years is 0.00 feet, indicating no net change.

Figure 7. Average annual change of land surface elevation of all benchmarks from 2010 to 2020.



In summary, the benchmark survey data show some land surface subsidence along the three CVLCs corresponding with the groundwater elevation decline between 2019 and 2020. However, there remains a low risk of permanent land subsidence in 2020. The average annual change of land surface elevation in the last 11 years at all benchmarks is 0.00 feet.

Discussion

As shown in Figure 1, the current land subsidence monitoring network consists of two extensometers, 140 benchmarks along three CVLCs, and ten subsidence groundwater monitoring wells covering most of the Santa Clara Plain. The extensometers monitor subsidence conditions at two sites with high-quality subsidence and water elevation data. The annual survey provides data representing the subsidence condition at benchmarks along three CVLCs. The monitoring of water elevations at subsidence index wells does not provide data to quantify the subsidence condition directly, but the monitoring is straightforward and related data can be used as an indicator for subsidence condition. Since the index wells are located throughout the Santa Clara Plain, the monitoring data reflects regional conditions.

The current Valley Water practice of evaluating the land subsidence condition in the Santa Clara Plain is to calculate the average over an 11-year period using subsidence data collected at two extensometers (Sunny and Martha) and compare it with the established, tolerable rate of land subsidence. The tolerable subsidence rate of 0.01 feet/year is based on the arithmetic average of historic subsidence and rebound measured in the Sunny and Martha extensometers for the 11-year period from 1980 to 1990 (GEOSCIENCE, 1991). Re-evaluation of the tolerable subsidence rate may be warranted to ensure the rate remains aligned with current groundwater conditions and management goals.

The subsidence thresholds established at ten index wells are used as the minimum water elevations that should be maintained to avoid further permanent land subsidence. Although the thresholds were established roughly thirty years ago, they were based on a thorough study of historical data, subsidence

modeling, and previous studies. It is recommended to continue to use these thresholds for groundwater operations and early indication of potential concerns. Because these thresholds are based on the 0.01 feet/year tolerable subsidence rate, they should be re-evaluated if the tolerable subsidence rate changes or if other information indicates a change is warranted.

The annual survey at benchmarks provides direct measurement of land surface changes along three CVLCs in the Santa Clara Plain. Valley Water will consider whether specific criteria should be developed to analyze survey data.

CONCLUSIONS

In summary, the data measured by each component of the subsidence monitoring network shows that:

- There was some change from 2019 to 2020 in the average groundwater elevations at the ten subsidence index wells. In general, 2020 groundwater elevations were lower than 2019 levels, which were close to or at historical high levels throughout the Santa Clara Plain. Groundwater elevations were higher than the subsidence thresholds at all ten index wells in 2020 in the Santa Clara Plain.
- Net aquifer compaction (or subsidence) was measured at both extensometer sites in 2020. The average annual subsidence rate over the last 11 years at the Martha and Sunny sites is -0.003 feet/year (net aquifer expansion or uplift), which meets Valley Water's tolerable rate of 0.01 feet/year.
- The benchmark survey data showed that the average land surface elevation of all benchmarks in 2020 was about the same as in 2019, and the average annual change of land surface elevation over last 11 years was 0.00 feet (no net change).

The analysis of the data collected through the Valley Water subsidence monitoring network indicates that the risk of permanent land subsidence in 2020 remains low. Continued monitoring of the subsidence network is recommended to detect early signs of inelastic land subsidence and to support sustainable groundwater supply.

REFERENCES

1. GEOSCIENCE Support Services Incorporated, 1991, Subsidence Threshold in the North County Area of Santa Clara Valley.
2. Santa Clara Valley Water District (SCVWD), 2016, Groundwater Management Plan for the Santa Clara and Llagas Subbasins.
3. Liu, Y., Pierno, R., and Gurdak, J.J., 2021, Memorandum – Replace the current PRESS #10 subsidence index well (07S01E16C006) with Martha North Extensometer Well 07S01E16C005, Santa Clara Valley Water District (Valley Water), Groundwater Management Unit, San Jose, CA, 11 pages.
4. Valley Water, 2020, 2019 Subsidence Data Analysis, Technical Memorandum (Memo).

APPENDIX B

Annual Groundwater Quality Summary Report

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Groundwater sampling equipment

Valley Water

Annual Groundwater Quality Summary

Did you know that groundwater is an essential local water resource, providing about half of the water used in Santa Clara County? Valley Water (Santa Clara Valley Water District) is committed to ensuring sustainable water supplies now and in the future. Valley Water's 2020 groundwater quality testing indicates generally high groundwater quality. We remain steadfast in our efforts to maintain this level of groundwater quality.

Valley Water works to safeguard groundwater by:

- Replenishing groundwater with local and imported surface water.
- Reducing the demand on groundwater with alternative water sources, water conservation and water recycling.
- Monitoring groundwater quality and water levels.
- Implementing programs to protect groundwater from contamination.

You can help protect groundwater by:

- Maintaining wells and septic systems and avoiding the use or storage of potential contaminants near wells.
- Conserving water and by raising awareness that activities above ground can affect our largest drinking water reservoir, which is beneath our feet.

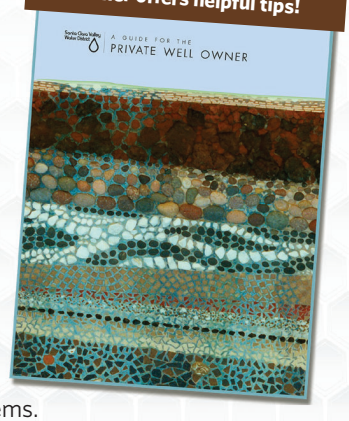
Clean Water • Healthy Environment • Flood Protection

What influences groundwater quality?

As water travels over the land and through the ground, it dissolves naturally occurring minerals and may also pick up substances from animal and human activities, such as:

- Inorganic compounds like salts and metals from natural or industrial sources, animal facilities, farming, and mining.
- Organic chemicals from industrial processes, gas stations, dry cleaners, agricultural uses, and septic systems.
- Insecticides, herbicides, and fertilizers from agricultural and residential uses.
- Viruses and bacteria from sewage treatment plants, sewer lines, septic systems, agricultural operations, and wildlife.
- Radioactive elements that are naturally occurring.

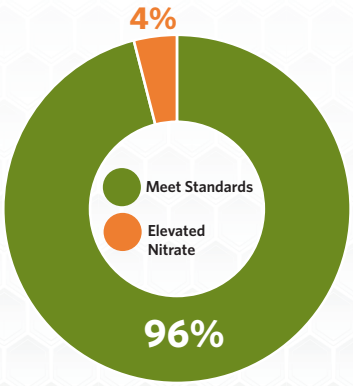
Our Guide for the Private Well Owner offers helpful tips!



How do I know if my water is safe?

State and federal drinking water standards identify contaminant levels that relate to health risks. Public water systems must meet these standards, but domestic wells are not regulated. Valley Water tests regional groundwater quality, but every property and well is unique, so we encourage domestic well owners to regularly test their water. The most common contaminant found in Santa Clara County is nitrate.

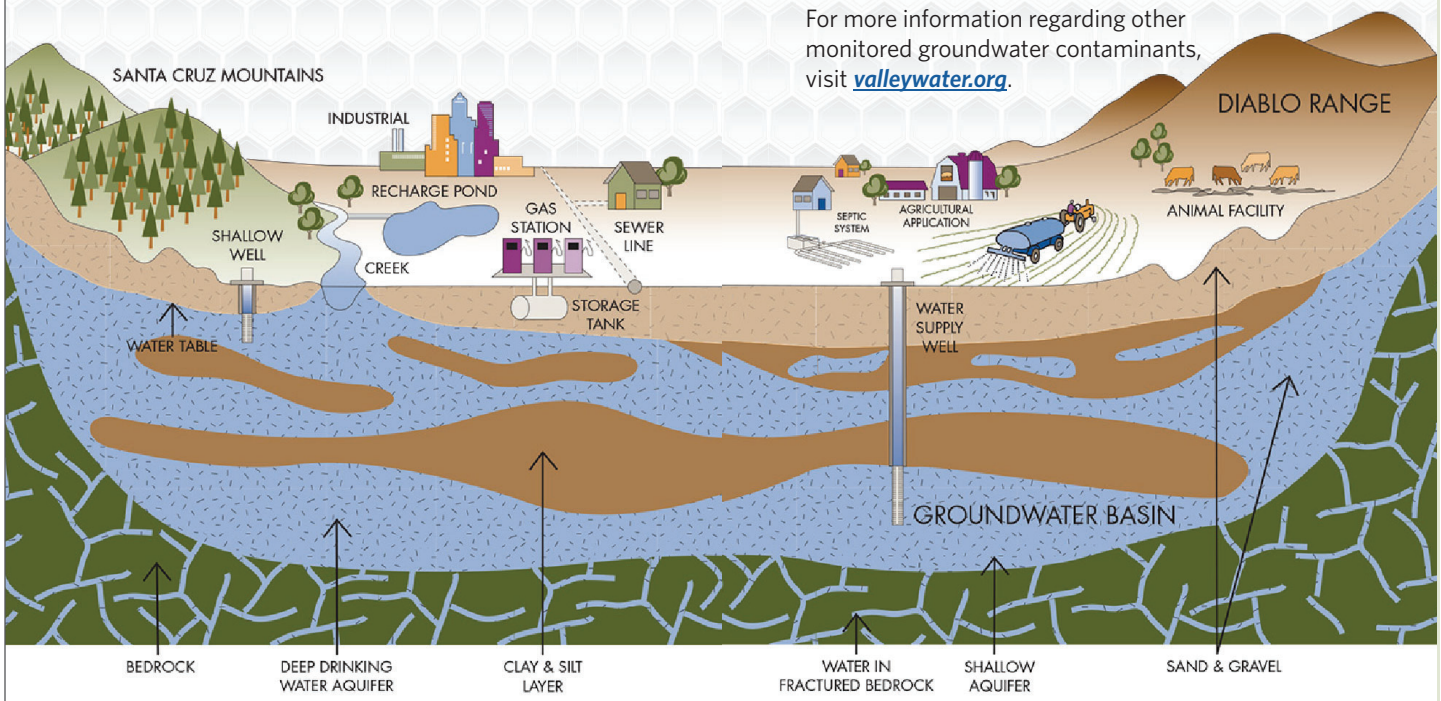
Water Supply Wells Tested Meeting Drinking Water Standards



Notes:
1. Graph shows primary drinking water standards.
2. All wells not meeting primary drinking water standards were South County wells with high nitrate (above 10 milligrams per liter)

Nitrate is present above the drinking water standard in many South County domestic wells due to fertilizers, septic systems and livestock waste. Nitrate can interfere with the blood's ability to transport oxygen and is of greatest concern for infants and pregnant women as it can cause serious illness; symptoms include shortness of breath and blueness of the skin.

For more information regarding other monitored groundwater contaminants, visit ***valleywater.org***.



	Primary Drinking Water Standards	Units	MCL	Sources	North County Median	North County Range	South County Median	South County Range
Inorganic Contaminants	Aluminum	ppb	1,000	a	ND	ND - 200	ND	ND - 65
	Arsenic	ppb	10	a,b	1.8	ND - 4.2	ND	ND - 5
	Asbestos	MFL	7	a	ND	ND	ND	ND - 0.2
	Barium	ppb	1,000	a	136	ND - 340	94	ND - 300
	Chromium (total)	ppb	50	a,b	ND	ND - 2	ND	ND - 1.8
	Copper[1]	ppb	1,300	a,c	3.6	ND - 3.9	2.8	ND - 9.4
	Fluoride (Natural Source)	ppm	2	a	0.12	ND - 0.27	0.13	ND - 0.22
	Lead[1]	ppb	15	a,b,c	ND	ND	ND	ND
	Nickel	ppb	100	a,b	ND	ND - 32	ND	ND - 5.6
	Nitrite (as N)	ppb	1	a,d	ND	ND	ND	ND - 0.3
	Nitrate + Nitrite (as N)	ppm	10	a,d	2.5	ND - 5.8	1.5	0.59 - 6.9
	Nitrate (as N)	ppm	10	a,d	3.0	ND - 8.1	5.2	ND - 38
	Perchlorate	ppb	6	e	ND	ND	ND	ND - 5.0
	Selenium	ppb	50	a	ND	ND - 5.8	ND	ND - 6.0
Radioactive Contaminants	Gross Alpha	pCi/L	15	a	1.7	ND - 5.6	1.6	0.42 - 4.0
	Uranium	pCi/L	20	a	1.1	ND - 1.3	ND	ND
Volatile Organic Compounds	1,1,1-Trichloroethane (1,1,1-TCA)	ppb	200	b,f	ND	ND - 0.9	ND	ND
	1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	ppb	1,200	b,f	ND	ND - 2.8	ND	ND
	1,1-Dichloroethene (1,1-DCE)	ppb	6	b	ND	ND - 0.83	ND	ND
	Haloacetic Acids (HAA5)	ppb	60	g	45	45	--	--
	Tetrachloroethene (PCE)	ppb	5	b,f	ND	ND	ND	ND - 1.6
	Total Trihalomethanes (THMs)	ppb	80	g	ND	ND - 44	ND	ND
					Present	Absent	Present	Absent
Microbiological Contaminants[2]	E. Coli Bacteria	P/A	--	h	0	1	0	22
	Total Coliform Bacteria	P/A	--	i	1	0	3	19
	Secondary Drinking Water Standards	**Units**	**MCL**	**Sources**	**Median**	**Range**	**Median**	**Range**
	Chloride	ppm	250	a,j	48	29 - 71	47	8.7 - 151
	Color	Color units	15	a	3.7	ND - 13	4	ND - 5
	Iron	ppb	300	a,b	43	ND - 310[3]	11	ND - 1,600
	Manganese	ppb	50	a,b	ND	ND - 122	ND	ND - 140
	Odor Threshold	TON	3	a	ND	ND - 1	ND	ND
	pH	pH units	6.5 - 8.5	a,k	7.5	6.1 - 8.3	7.4	7 - 7.8
	Specific Conductance	uS/cm	900	a,j	680	450 - 1,100	573	365 - 1,250
	Sulfate	ppm	250	a,b	50	30 - 120	38	22 - 99
	Total Dissolved Solids (TDS)	ppm	500	a	440	280 - 660	375	226 - 714
	Turbidity	NTU	5	l	0.21	ND - 1	0.23	ND - 3.2
	Zinc	ppb	5,000	a,b	ND	ND - 18	ND	ND - 44

Water Quality Summary

In 2020, Valley Water evaluated data from over 260 public and private water supply wells. Nearly all wells tested meet drinking water standards except for nitrate in some South County wells.

This table summarizes results for detected parameters that have a drinking water standard. Not every well was tested for all substances listed. Comprehensive results are reported in the most recent Annual Groundwater Report at *valleywater.org*. Maximum Contaminant Levels (MCLs) apply only to public water systems but are useful guidelines for domestic wells. This regional summary may not reflect the water quality in individual wells since every property and well is unique.

Table Notes

1) Lead and copper do not have MCLs, but have "action levels" as shown, and are regulated by the state for public water systems since they can adversely affect public health.

2) Public water systems are required to ensure that fewer than 5% of samples per month have total coliform present and that no samples have e. coli present. Domestic wells are not subject to these standards.

3) Public water systems are required to ensure Two high iron results (2,100 and 6,000 ppb) are are not included in this table since subsequent tests did not confirm high iron.

Table Terms and Definitions

Maximum Contaminant Level (MCL): the highest level of a contaminant allowable in public water systems. Primary MCLs are health-based regulatory standards. Secondary MCLs are aesthetic standards and relate to the taste, odor, or appearance of drinking water.
Median: the "middle" value of the results, with half of the values above the median and half of the values below the median.
--: indicates there is no related drinking water standard or that the substance was not tested or detected.
MFL: million fibers per liter
ND: not detected (at laboratory reporting limit)
NTU: nephelometric turbidity units
P/A: Present/Absent
pCi/L: picoCuries per liter (a measure of radiation)
ppb: parts per billion (micrograms per liter)
ppm: parts per million (milligrams per liter)
pH units: measure of pH
TON: threshold odor number
uS/cm: microSiemens per centimeter (a measure of the dissolved inorganic salt content)

Typical Sources for Listed Substances

a: Erosion of natural deposits
b: Discharge of industrial and manufacturing wastes
c: Internal corrosion of household water plumbing systems
d: Agricultural runoff and leaching of fertilizers, septic tanks, and sewage
e: Solid rocket propellant, fireworks, explosives, flares, matches, and other industrial sources
f: Industrial process, dry cleaners, automotive repair shops, leaking underground fuel tanks, and other industrial sources
g: Byproduct of drinking water disinfection
h: Human and animal fecal wastes
i: Naturally occurring in environment
j: Seawater influence
k: Carbon dioxide emissions; rainfall
l: Soil runoff

You live on a groundwater basin.

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Valley Water Resources for Well Owners

Individual well owners are responsible for making sure their water is safe to drink, but Valley Water offers several resources to help.

Domestic Well Testing
Valley Water offers free water quality testing for eligible Santa Clara County domestic well users. Testing includes common contaminants like nitrate and bacteria.

Nitrate Frequently Asked Questions
For more information regarding nitrate, see Valley Water's Nitrate in Groundwater FAQ sheet.

For more program information, visit *valleywater.org* or call the Groundwater Hotline at (408) 630-2300.

Additional Resources

For more information about contaminants and potential health effects, the following resources are available:

- U.S. Environmental Protection Agency's Safe Drinking Water Hotline at (800) 426-4791
- California Division of Drinking Water (www.waterboards.ca.gov/drinking_water/programs)
- Your healthcare provider

Contact Us information

For more information, contact the Groundwater Hotline at **(408) 630-2300**.

To find out the latest information on Valley Water projects or to submit questions or comments, use our **Access Valley Water** customer request system at https://delivr.com/2yukx.

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APPENDIX C
2020 Groundwater Quality Results

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Table C-1 Summary of 2020 Water Quality Indicator Data

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain								Santa Clara Subbasin, Coyote Valley				Maximum Contaminant Level	
		Shallow Zone[2]				Principal Zone[3]									
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
Aggressive Index (Corrosivity)	Index	--	--	--	--	40	10.64	12.1	13	5	11.99	12.00	12.03	--	--
Bicarbonate (as HCO3)	mg/L	20	213	345	689	61	130	280	490	10	189	240	356	--	--
Bicarbonate Alkalinity (as CaCO3)	mg/L	20	174	283	565	18	136	224	362	5	155	206	292	--	--
Carbonate (as CO3)	mg/L	20	<5	<5	<50	26	<2	<5	<5	7	<2	<5	<5	--	--
Carbonate Alkalinity (as CaCO3)	mg/L	20	<5	<5	<50	18	<5	<5	<5	5	<5	<5	<5	--	--
Total Alkalinity (as CaCO3)	mg/L	20	174	283	565	61	100	237	400	10	155	197	292	--	--
Caffeine	µg/L	--	--	--	--	34	<0.05	<0.05	<0.05	4	<0.05	<0.05	<0.05	--	--
Color	Color Units	--	--	--	--	16	<3	5	15	2	<3	<3	<3	--	15
Foaming Agents (MBAS)	µg/L	--	--	--	--	8	<100	<100	<100	2	<100	<100	<100	--	500
Hardness (Total, as CaCO3)	mg/L	20	188	336	673	61	81	294	526	10	214	242	310	--	--
Hydroxide (as OH)	mg/L	20	<5	<5	<50	26	<1.4	<5	<5	7	<2	<5	<5	--	--
Hydroxide Alkalinity (as CaCO3)	mg/L	20	<5	<5	<50	18	<5	<5	<5	5	<5	<5	<5	--	--
Langelier Index @ 60 C	Index	--	--	--	--	7	0.44	0.97	1.1	2	0.82	0.91	1	--	--
Langelier Index @ Source Temp	Index	--	--	--	--	20	-1.46	-0.03	0.55	--	--	--	--	--	--
Odor Threshold @ 60 C	TON	--	--	--	--	46	<1	<1	1	5	<1	<1	<1	--	3
Specific Conductance	µS/cm	53	398	768	1,490	176	324	660	4,110	24	344	556	1,220	--	(900)
Total Organic Carbon (TOC)	mg/L	--	--	--	--	3	<0.3	<0.3	<0.3	--	--	--	--	--	--
Turbidity	NTU	53	<0.1	0.36	37	110	<0.1	0.27	11.4	21	<0.1	0.27	1.31	--	5
E. Coli (P/A)	P/A	1	0 Present	1 Absent		--	--	--	--	1	0 Present	1 Absent		--	--
Total Coliform (P/A) [9]	P/A	1	1 Present	0 Absent						1	0 Present	1 Absent		--	--

Table C-1 Summary of 2020 Water Quality Indicator Data

Parameter	Units[1]	Llagas Subbasin								Maximum Contaminant Level	
		Shallow Zone[2]				Principal Zone[3]					
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
Aggressive Index (Corrosivity)	Index	--	--	--	--	9	11.8	11.9	12	--	--
Bicarbonate (as HCO3)	mg/L	18	129	276	428	28	68	230	446	--	--
Bicarbonate Alkalinity (as CaCO3)	mg/L	17	106	226	351	18	99	203	366	--	--
Carbonate (as CO3)	mg/L	17	<5	<5	<5	18	<5	<5	<5	--	--
Carbonate Alkalinity (as CaCO3)	mg/L	17	<5	<5	<5	18	<5	<5	<5	--	--
Total Alkalinity (as CaCO3)	mg/L	18	106	226	351	28	99	190	366	--	--
Color	Color Units	--	--	--	--	2	5	5	5	--	15
E. Coli (MPN)	MPN/100mL	2	<1	<1	<1	2	<1	<1	<1	--	--
Foaming Agents (MBAS)	µg/L	2	<0.1	<0.1	<0.1	2	<0.1	<0.1	<0.1	--	500
Hardness (Total, as CaCO3)	mg/L	17	186	299	497	28	196	269	503	--	--
Heterotrophic Plate Count	CFU/mL	2	470	835	1,200	2	500	950	1,400	--	--
Hydroxide (as OH)	mg/L	17	<5	<5	<5	18	<5	<5	<5	--	--
Hydroxide Alkalinity (as CaCO3)	mg/L	17	<5	<5	<5	18	<5	<5	<5	--	--
Langelier Index @ 60 C	Index	--	--	--	--	2	0.14	0.14	0.14	--	--
Odor Threshold @ 60 C	TON	--	--	--	--	9	<1	<1	<1	--	3
Specific Conductance	µS/cm	43	276	681	1,160	68	365	598	1,250	--	(900)
Turbidity	NTU	41	<0.1	0.5	2.33	48	<0.1	0.26	3.2	--	5
Total Coliform (MPN)	MPN/100mL	2	<1	<1	<1	2	<1	<1	<1	--	--
E. Coli (P/A)	P/A	4	0 Present	4 Absent		14	0 Present	14 Absent		--	--
Total Coliform (P/A) [9]	P/A	4	2 Present	2 Absent		14	1 Present	13 Absent		--	--

Table C-1 Summary of 2020 Water Quality Indicator Data (Notes)

Table includes data for wells monitored by Valley Water (annual monitoring network wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).

Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1. CFU/mL = colony-forming unit per milliliter ; µg/L = micrograms per liter; mg/L = milligrams per liter; P/A = present/absent per 100 ml; µS/cm = microSiemens per centimeter; MPN/100mL = most probable number per 100 milliliters; NTU = Nephelometric Turbidity Units; TON = Threshold Odor. Number
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when there are no quantified values at the lowest reporting limit.
6. For parameters with results reported at multiple reporting limits, the median was computed using the Maximum Likelihood Estimate (MLE) method.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA. For SMCLs having a range, the lower, recommended threshold is listed first with the upper threshold in parentheses.
9. Total coliform and e. coli bacteria are regulated under the US EPA Total Coliform Rule, which identifies sampling requirements and compliance criteria based on the type of public water system. All wells with data in bacteria results in this table are private, domestic wells that are not subject to federal or state drinking water requirements.

Table C-2 Summary of 2020 Inorganic Data

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain								Santa Clara Subbasin, Coyote Valley				Maximum Contaminant Level	
		Shallow Zone[2]				Principal Zone[3]									
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
Major and Minor Ions															
Bromide	mg/L	12	<0.1	0.18	0.35	21	<0.1	0.14	0.26	5	<0.1	0.12	0.23	--	--
Calcium	mg/L	20	34.1	71.6	155	61	16.7	63	120	10	6.2	45	59	--	--
Calcium (as CaCO3)	mg/L	20	85	179	378	18	41.7	131	269	5	15.5	109	145	--	--
Carbon Dioxide	µg/L	--	--	--	--	24	10	26	7,000	2	6,000	6,900	7,800	--	--
Chloride	mg/L	21	23	54	79	64	9	46	148	10	12	39	83	--	(250)
Cyanide	µg/L	--	--	--	--	103	<100	<100	<100	6	<100	<100	<100	150	--
Magnesium	mg/L	20	12.4	35.5	69.5	61	7	27	72	10	25.6	32.5	51.6	--	--
Perchlorate	µg/L	12	<4	<4	<4	124	<4	<4	<4	10	<4	<4	<4	6	--
Potassium	mg/L	20	0.6	1.3	2.2	57	<1	1.4	4.4	9	0.8	1.3	1.8	--	--
Sodium	mg/L	20	21	40	134	61	14.2	33	108	10	17	23	104	--	--
Sulfate	mg/L	13	30.4	58.7	163	64	2.1	50	120	10	2.1	40	63	--	(250)
Total Dissolved Solids (TDS)	mg/L	12	326	451	804	61	248	420	660	14	280	334	488	--	(500)
Nutrients															
Ammonia (NH3-N)	mg/L	--	--	--	--	3	<0.05	<0.05	<0.05	--	--	--	--	--	--
Nitrate (as N)	mg/L	13	<0.1	1.73	3.73	307	<0.1	2.9	8.5	32	0.39	1.25	19.2	10	--
Nitrate + Nitrite (as N)	mg/L	1	3.2	3.2	3.2	61	<0.1	2.4	5.8	11	0.59	0.75	6.5	10	--
Nitrite (as N)	mg/L	1	<0.4	<0.4	<0.4	69	<0.4	<0.4	<0.4	11	<0.4	<0.4	<0.4	1	--
Orthophosphate (as PO4)	mg/L	12	<0.1	0.106	0.48	21	<0.1	0.12	1.9	5	<0.1	0.11	0.47	--	--
Trace Elements															
Aluminum	µg/L	20	<20	<20	100	65	<20	<50	180	11	<20	<50	<50	1,000	200
Antimony	µg/L	20	<1	<1	<1	62	<1	<6	<6	11	<1	<6	<6	6	--
Arsenic	µg/L	20	<2	<2	3	62	<2	<2	5	11	<2	<2	2.4	10	--
Asbestos	MFL	--	--	--	--	78	<0.2	<0.2	<0.2	1	<0.2	<0.2	<0.2	7	--
Barium	µg/L	20	32	110	170	62	<100	127	340	11	<100	103	250	1,000	--
Beryllium	µg/L	20	<1	<1	<1	62	<1	<1	<2	11	<1	<1	<1	4	--
Boron	µg/L	20	92.6	169	300	21	<100	121	303	5	<50	110	138	--	--
Cadmium	µg/L	20	<1	<1	<1	62	<1	<1	<2	11	<1	<1	<1	5	--
Chromium	µg/L	20	<1	0.73	4.3	65	<1	<1	9.3	11	<10	1.7	3.9	50	--
Chromium 6 (Hexavalent)	µg/L	20	<1	<1	4.4	37	<1	1.5	9.9	8	<1	3	5	--	--
Cobalt	µg/L	--	--	--	--	3	<1	<1	<1	--	--	--	--	--	--
Copper	µg/L	20	<1	<1	3.6	61	<1	<1	3.9	10	<1	<1	1.9	1,300	1,000
Fluoride (natural source)	mg/L	12	<0.1	0.15	0.33	66	<0.1	0.12	0.29	11	<0.1	0.14	0.16	2	--
Iron	µg/L	20	<20	<20	310	115	<100	19	600	13	<20	<100	<100	--	300
Lead	µg/L	20	<1	<1	<1	65	<1	<5	<5	14	<1	<5	<5	15	--
Lithium	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	µg/L	20	<1	5.6	979	69	<1	0.89	139	10	<1	<20	104	--	50
Mercury	µg/L	20	<1	<1	<1	59	<1	<1	<1	11	<1	<1	<1	2	--
Molybdenum	µg/L	--	--	--	--	3	<1	<1	<1	--	--	--	--	--	--
Nickel	µg/L	20	<2	0.65	2.3	62	<1	<10	12	11	<1	<10	<10	100	--
Selenium	µg/L	20	<5	<5	<5	62	<5	<5	5.8	11	<5	<5	<5	50	--
Silica	mg/L	--	--	--	--	3	27.6	28.5	29.7	--	--	--	--	--	--
Silicon (Dissolved)	mg/L	20	9.3	11.2	15.6	18	8.6	12.7	19.2	5	9.7	10.5	16.6	--	--
Silver	µg/L	20	<1	<1	<1	61	<1	<10	<10	10	<1	<10	<10	--	100
Thallium	µg/L	20	<1	<1	<1	62	<1	<1	<2	11	<1	<1	<1	2	--
Vanadium	µg/L	20	<1	1.8	4.3	21	<1	1.8	3.6	5	1	1.4	9.8	--	--
Zinc	µg/L	20	<10	<10	25	61	<10	<10	23	10	<10	<50	<50	--	5,000

Table C-2 Summary of 2020 Inorganic Data

Parameter	Units[1]	Llagas Subbasin								Maximum Contaminant Level	
		Shallow Zone				Principal Zone					
		n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
Major and Minor Ions											
Bromate	µg/L	1	<0.25	<0.25	<0.25	1	<0.25	<0.25	<0.25	10	--
Bromide	mg/L	18	<0.1	0.15	0.36	20	<0.1	0.19	0.35	--	--
Calcium	mg/L	18	27	57	89.1	28	34.5	55	103	--	--
Calcium (as CaCO3)	mg/L	18	67.5	141	222	19	86.1	138	258	--	--
Carbon Dioxide	µg/L	--	--	--	--	--	--	--	--	--	--
Chloride	mg/L	18	12	43	70	33	8.7	48	151	--	(250)
Cyanide	µg/L	2	<0.025	<0.025	<0.025	12	<0.025	<100	<100	150	--
Magnesium	mg/L	18	14.2	37.6	66.6	28	18.3	31	59.5	--	--
Perchlorate	µg/L	18	<4	<4	<4	54	<2	2	5	6	--
Potassium	mg/L	18	<0.5	1.1	1.8	27	<0.5	1.5	2.1	--	--
Sodium	mg/L	18	11.2	26.9	73.6	32	12	28	90.7	--	--
Sulfate	mg/L	18	20.3	46.8	132	33	4.4	37.5	99	--	(250)
Total Dissolved Solids (TDS)	mg/L	18	230	398	688	33	226	375	714	--	(500)
Nutrients											
Ammonia (NH3-N)	mg/L	--	--	--	--	--	--	--	--	--	--
Nitrate (as N)	mg/L	18	<0.1	10	47.5	181	<0.1	5.3	38	10	--
Nitrate + Nitrite (as N)	mg/L	--	--	--	--	14	<0.4	1.6	6.9	10	--
Nitrite (as N)	mg/L	1	<0.05	<0.05	<0.05	27	<0.4	<0.4	0.3	1	--
Orthophosphate (as PO4)	mg/L	18	<0.1	<0.1	0.2	20	<0.1	0.13	0.99	--	--
Trace Elements											
Aluminum	µg/L	18	<20	<20	27	29	<20	<50	65	1,000	200
Antimony	µg/L	18	<1	<1	<1	29	<1	<1	<6	6	--
Arsenic	µg/L	18	<2	<2	<2	29	<2	<2	5	10	--
Asbestos	MFL	--	--	--	--	18	<0.2	<0.2	0.2	7	--
Barium	µg/L	18	10	120	360	29	<100	106	470	1,000	--
Beryllium	µg/L	18	<1	<1	<1	29	<1	<1	<1	4	--
Boron	µg/L	18	<50	116	179	21	<50	94	218	--	--
Cadmium	µg/L	18	<1	<1	<1	29	<1	<1	<1	5	--
Chromium	µg/L	18	<1	1.4	5.1	29	<1	1.3	2.3	50	--
Chromium 6 (Hexavalent)	µg/L	16	<1	0.765	5.11	19	<1	1.2	6.8	--	--
Cobalt	µg/L	1	<1	<1	<1	1	<1	<1	<1	--	--
Copper	µg/L	18	<1	<1	6.9	28	<1	1.6	9.4	1,300	1,000
Fluoride (natural source)	mg/L	18	<0.1	<0.1	0.2	30	<0.1	0.11	0.37	2	--
Iron	µg/L	18	<20	<20	77	30	<20	21	1,600	--	300
Lead	µg/L	18	<1	<1	<1	29	<1	<1	<5	15	--
Lithium	µg/L	1	5.7	5.7	5.7	1	11	11	11	--	--
Manganese	µg/L	18	<1	<1	82.9	29	<1	0.85	140	--	50
Mercury	µg/L	18	<1	<1	<1	29	<1	<1	<1	2	--
Molybdenum	µg/L	1	<1	<1	<1	1	4.5	4.5	4.5	--	--
Nickel	µg/L	18	<1	<1	2.4	29	<1	<1	5.6	100	--
Selenium	µg/L	18	<5	<5	6	29	<5	<5	<5	50	--
Silica	mg/L	1	24.1	24.1	24.1	1	34.9	34.9	34.9	--	--
Silicon (Dissolved)	mg/L	17	9.8	14.2	20.2	18	10.3	12.9	20.6	--	--
Silver	µg/L	18	<1	<1	<1	28	<1	<1	<10	--	100
Thallium	µg/L	18	<1	<1	<1	29	<1	<1	<1	2	--
Vanadium	µg/L	18	<1	1.6	14	19	<1	2.5	12	--	--
Zinc	µg/L	18	<10	<10	220	28	<10	1	200	--	5,000

Table C-2 Summary of 2020 Inorganic Data (Notes)

Table includes data for wells monitored by the Valley Water (annual monitoring network wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).

Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1. mg/L = milligrams per liter; µg/L = micrograms per liter; MFL = million fibers per liter.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a
5. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when
6. For parameters with results with multiple reporting limits, the median was computed using the Maximum
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA. For
9. Lead and copper do not have primary MCLs but have "action levels" of 15 and 1,300 ppb, respectively.

Table C-3 Summary of 2020 Volatile Organic Compound (VOC) Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
1,1,1,2-Tetrachlorethane	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
1,1,1-Trichloroethane	µg/L	1	**D**	NA	90	**D**	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	200	--
1,1,2,2-Tetrachloroethane	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	1	--
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	µg/L	1	ND	10	90	**D**	10	5	ND	10	2	ND	2	51	ND	2	1,200	--
1,1,2-Trichloroethane	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	5	--
1,1-Dichloroethane	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	5	--
1,1-Dichloroethene	µg/L	1	ND	0.5	90	**D**	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	6	--
1,1-Dichloropropene	µg/L	1	ND	0.5	9	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
1,2,3-Trichlorobenzene	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
1,2,3-Trichloropropane	µg/L	--	--	--	214	ND	0.005	6	ND	0.005	1	ND	0.5	15	ND	0.005	0.005	--
1,2,4-Trichlorobenzene	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	5	--
1,2,4-Trimethylbenzene	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	5	--
1,2-Dichlorobenzene	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	600	--
1,2-Dichloroethane	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	0.5	--
1,2-Dichloropropane	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	5	--
1,3,5-Trimethylbenzene	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
1,3-Dichlorobenzene	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
1,3-Dichloropropane	µg/L	1	ND	0.5	9	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
1,3-Dichloropropene (Total)	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	0.5	--
1,4-Dichlorobenzene	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	5	--
11-chloroeicosafluoro-3-oxaundecane-sulfonic acid	ng/L	13	ND	0.002	204	ND	0.002	7	ND	0.002	9	ND	0.002	7	ND	0.002	--	--
1-Phenylpropane (n-Propylbenzene)	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
2,2-Dichloropropane	µg/L	1	ND	0.5	9	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
2,4-Dinitrotoluene	µg/L	--	--	--	4	ND	5	4	ND	5	--	--	--	--	--	--	--	--
2-Chlorotoluene	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	ng/L	13	ND	0.002	204	ND	0.002	7	ND	0.002	9	ND	0.002	7	ND	0.002	--	--
4-Chlorotoluene	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
9-chlorohexadecafluoro-3-oxanone-sulfonic acid	ng/L	13	ND	0.002	204	ND	0.002	7	ND	0.002	9	ND	0.002	7	ND	0.002	--	--
Benzene	µg/L	1	ND	0.5	89	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	1	--
Benzo (a) Pyrene	µg/L	--	--	--	205	ND	0.1	7	ND	0.1	--	--	--	7	ND	0.1	0.2	--
Bromobenzene	µg/L	1	ND	0.5	9	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--

Table C-3 Summary of 2020 Volatile Organic Compound (VOC) Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
Bromochloroacetic Acid (BCAA)	µg/L	--	--	--	--	--	--	--	--	--	2	ND	0.3	2	ND	0.3	--	--
Bromochloromethane	µg/L	1	ND	0.5	9	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
Bromodichloroacetic Acid (BDCAA)	µg/L	--	--	--	--	--	--	--	--	--	2	ND	0.5	2	ND	0.5	--	--
Bromodichloromethane (THM)	µg/L	1	ND	1	22	**D**	1	2	ND	1	2	ND	0.5	4	ND	0.5	--	--
Bromoform (THM)	µg/L	1	ND	1	22	ND	1	2	ND	1	2	ND	0.5	4	ND	0.5	--	--
Bromomethane	µg/L	1	ND	0.5	9	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
Carbon Disulfide	µg/L	1	ND	0.5	5	ND	0.5	2	ND	0.5	--	--	--	--	--	--	--	--
Carbon Tetrachloride	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	0.5	--
Chloroethane	µg/L	1	ND	0.5	9	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
Chloroform (THM)	µg/L	1	ND	1	22	**D**	1	2	ND	1	2	ND	0.5	4	ND	0.5	--	--
Chloromethane	µg/L	1	ND	0.5	9	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
cis-1,2-Dichloroethene	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	6	--
cis-1,3-Dichloropropene	µg/L	1	ND	0.5	5	ND	0.5	2	ND	0.5	2	ND	0.5	2	ND	0.5	--	--
Di(2-Ethylhexyl) Adipate	µg/L	--	--	--	205	ND	5	7	ND	5	--	--	--	7	ND	5	400	--
Di(2-Ethylhexyl) Phthalate	µg/L	--	--	--	205	ND	3	7	ND	3	--	--	--	7	ND	3	4	--
Dibromoacetic Acid (DBAA)	µg/L	--	--	--	1	ND	1	--	--	--	2	ND	0.3	2	ND	0.3	--	--
Dibromochloroacetic Acid (CDBAA)	µg/L	--	--	--	--	--	--	--	--	--	2	ND	0.3	2	ND	0.3	--	--
Dibromochloromethane (THM)	µg/L	1	ND	1	22	ND	1	2	ND	1	2	ND	0.5	4	ND	0.5	--	--
Dibromochloropropane (DBCP)	µg/L	--	--	--	193	ND	0.01	7	ND	0.01	--	--	--	10	ND	0.01	0.2	--
Dibromomethane	µg/L	1	ND	0.5	9	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
Dichloroacetic Acid (DCAA)	µg/L	--	--	--	1	**D**	NA	--	--	--	2	ND	0.2	2	ND	0.2	--	--
Dichlorodifluoromethane (Freon 12)	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
Dichloromethane	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	5	--
Diisopropyl Ether	µg/L	1	ND	3	9	ND	3	2	ND	3	2	ND	2	4	ND	2	--	--
Ethylbenzene	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	300	--
Ethylene Dibromide (EDB)	µg/L	--	--	--	193	ND	0.02	7	ND	0.02	--	--	--	10	ND	0.02	0.05	--
Ethylenediamine Tetra-Acetic Acid (EDTA)	mg/L	--	--	--	--	--	--	--	--	--	2	ND	0.1	2	ND	0.1	--	--
Ethyl-Tert-Butyl Ether	µg/L	1	ND	3	21	ND	3	2	ND	3	2	ND	2	4	ND	2	--	--
Formaldehyde	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	0.002	--	--
Haloacetic Acids (HAA5)	µg/L	--	--	--	1	**D**	NA	--	--	--	2	ND	0.2	2	ND	0.2	60	--
Haloacetic acids (HAA6Br)	µg/L	--	--	--	--	--	--	--	--	--	1	ND	0.2	1	ND	0.2	--	--
Haloacetic acids (HAA9)	µg/L	--	--	--	--	--	--	--	--	--	1	ND	0.2	1	ND	0.2	--	--

Table C-3 Summary of 2020 Volatile Organic Compound (VOC) Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
Hexachlorobutadiene	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
Hexafluoropropylene oxide dimer acid (HFPO-DA)	ng/L	13	ND	0.002	204	ND	0.005	7	ND	0.005	9	ND	0.005	7	ND	0.005	--	--
Isopropylbenzene	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
m,p-Xylene	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	7	ND	0.5	--	--
Methyl Ethyl Ketone (MEK, Butanone)	µg/L	1	ND	5	6	ND	5	2	ND	5	--	--	--	2	ND	5	--	--
Methyl Isobutyl Ketone	µg/L	1	ND	5	18	ND	5	2	ND	5	--	--	--	2	ND	5	--	--
Methyl Tert-Butyl Ether (MTBE)	µg/L	1	ND	3	92	ND	3	5	ND	3	2	ND	2	51	ND	2	13	5
Monobromoacetic Acid (MBAA)	µg/L	--	--	--	1	ND	1	--	--	--	2	ND	0.3	2	ND	0.3	--	--
Monochloroacetic Acid (MCAA)	µg/L	--	--	--	1	ND	2	--	--	--	2	ND	2	2	ND	2	--	--
Monochlorobenzene	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	70	--
Naphthalene	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
n-Butylbenzene	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
N-ethyl Perfluorooctanesulfonamidoacetic acid	ng/L	13	ND	0.002	204	ND	0.002	7	ND	0.002	9	ND	0.002	7	ND	2	--	--
Nitrilotriacetic Acid (NTA)	mg/L	--	--	--	--	--	--	--	--	--	2	ND	0.1	2	ND	0.1	--	--
N-methyl Perfluorooctanesulfonamidoacetic acid	ng/L	13	ND	0.002	204	ND	0.002	7	ND	0.002	9	ND	0.002	7	ND	0.002	--	--
n-Nitrosodiethylamine (NDEA)	µg/L	--	--	--	--	--	--	--	--	--	2	ND	2	2	ND	2	--	--
n-Nitrosodimethylamine (NDMA)	µg/L	--	--	--	--	--	--	--	--	--	2	ND	2	2	ND	2	--	--
n-Nitrosodi-n-Butylamine (NDBA)	µg/L	--	--	--	--	--	--	--	--	--	2	ND	2	2	ND	2	--	--
n-Nitrosodi-n-Propylamine (NDPA)	µg/L	--	--	--	--	--	--	--	--	--	2	ND	2	2	ND	2	--	--
n-Nitrosomethylethylamine (NMEA)	µg/L	--	--	--	--	--	--	--	--	--	2	ND	2	2	ND	2	--	--
n-Nitrosomorpholine (NMOR)	ng/L	--	--	--	--	--	--	--	--	--	1	ND	2	1	ND	2	--	--
n-Nitrosopiperidine (NPIP)	µg/L	--	--	--	--	--	--	--	--	--	2	ND	2	2	ND	2	--	--
n-Nitrosopyrrolidine (NPYR)	µg/L	--	--	--	--	--	--	--	--	--	2	ND	2	2	ND	2	--	--
o-Xylene	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	7	ND	0.5	--	--
PCB-1016	µg/L	--	--	--	205	ND	0.5	7	ND	0.5	--	--	--	8	ND	0.5	--	--
PCB-1221	µg/L	--	--	--	205	ND	0.5	7	ND	0.5	--	--	--	8	ND	0.5	--	--
PCB-1232	µg/L	--	--	--	205	ND	0.5	7	ND	0.5	--	--	--	8	ND	0.5	--	--
PCB-1242	µg/L	--	--	--	205	ND	0.5	7	ND	0.5	--	--	--	8	ND	0.5	--	--
PCB-1248	µg/L	--	--	--	205	ND	0.5	7	ND	0.5	--	--	--	8	ND	0.5	--	--
PCB-1254	µg/L	--	--	--	205	ND	0.5	7	ND	0.5	--	--	--	8	ND	0.5	--	--

Table C-3 Summary of 2020 Volatile Organic Compound (VOC) Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
PCB-1260	µg/L	--	--	--	205	ND	0.5	7	ND	0.5	--	--	--	8	ND	0.5	--	--
Perfluorobutanesulfonic acid (PFBS)	ng/L	13	**D**	0.002	204	**D**	0.002	7	**D**	0.002	9	**D**	0.002	7	**D**	0.002	--	--
Perfluorodecanoic acid (PFDA)	ng/L	13	ND	0.002	204	ND	0.002	7	ND	0.002	9	ND	0.002	7	ND	0.002	--	--
Perfluorododecanoic acid (PFDoA)	ng/L	13	ND	0.002	204	ND	0.002	7	ND	0.002	9	ND	0.002	7	ND	0.002	--	--
Perfluoroheptanoic acid (PFHPA)	ng/L	13	**D**	0.002	204	**D**	0.002	7	ND	0.002	9	ND	0.002	7	ND	0.002	--	--
Perfluorohexane Sulfonic Acid (PFHxS)	ng/L	13	**D**	0.002	204	**D**	0.002	7	ND	0.002	9	ND	0.002	7	**D**	0.002	--	--
Perfluorohexanoic Acid (PFHxA)	ng/L	13	**D**	0.002	204	**D**	0.002	7	ND	0.002	9	**D**	0.002	7	**D**	0.002	--	--
Perfluorononanoic acid (PFNA)	ng/L	13	**D**	0.002	204	**D**	0.002	7	ND	0.002	9	ND	0.002	7	ND	0.002	--	--
Perfluorooctanoic Acid (PFOA)	ng/L	13	**D**	0.002	205	**D**	0.002	7	ND	0.002	9	**D**	0.002	7	**D**	0.002	--	--
Perfluorooctyl Sulfonate (PFOS)	ng/L	13	**D**	0.002	205	**D**	0.002	7	**D**	0.002	9	**D**	0.002	7	**D**	0.002	--	--
Perfluorotetradecanoic acid (PFTA)	ng/L	13	ND	0.002	204	ND	0.002	7	ND	0.002	9	ND	0.002	7	ND	0.002	--	--
Perfluorotridecanoic acid (PFTrDA)	ng/L	13	ND	0.002	204	ND	0.002	7	ND	0.002	9	ND	0.002	7	ND	0.002	--	--
Perfluoroundecanoic acid (PFUnA)	ng/L	13	ND	0.002	204	ND	0.002	7	ND	0.002	9	ND	0.002	7	ND	0.002	--	--
Phenol	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	1	ND	5	--	--
p-Isopropyltoluene	µg/L	1	ND	0.5	8	ND	0.5	2	ND	0.5	2	ND	0.5	2	ND	0.5	--	--
Polychlorinated Biphenyls (Total PCBs)	µg/L	--	--	--	205	ND	0.5	8	ND	0.5	--	--	--	9	ND	0.5	0.5	--
sec-Butylbenzene	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
Styrene	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	100	--
Tert-Amyl Methyl Ether (TAME)	µg/L	1	ND	3	21	ND	3	2	ND	3	2	ND	2	4	ND	2	--	--
Tert-Butyl Alcohol (TBA)	µg/L	--	--	--	3	ND	2	--	--	--	2	ND	2	4	ND	2	--	--
Tert-Butylbenzene	µg/L	1	ND	0.5	21	ND	0.5	2	ND	0.5	2	ND	0.5	4	ND	0.5	--	--
Tetrachloroethene	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	**D**	0.5	5	--
Toluene	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	150	--
Total Trihalomethanes	µg/L	1	ND	0.5	6	**D**	0.5	2	ND	0.5	1	ND	0.5	1	ND	0.5	80	--
trans-1,2,Dichloroethene	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	10	--
trans-1,3,Dichloropropene	µg/L	1	ND	0.5	5	ND	0.5	2	ND	0.5	2	ND	0.5	2	ND	0.5	--	--
Tribromoacetic Acid (TBAA)	µg/L	--	--	--	--	--	--	--	--	--	2	ND	2	2	ND	0.5	--	--
Trichloroacetic Acid (TCAA)	µg/L	--	--	--	1	**D**	1	--	--	--	2	ND	0.5	2	ND	0.5	--	--
Trichloroethene	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	5	--
Trichlorofluoromethane (Freon 11)	µg/L	1	ND	5	90	ND	5	5	ND	5	2	ND	2.5	51	ND	2.5	150	--
Vinyl Chloride	µg/L	1	ND	0.5	90	ND	0.5	5	ND	0.5	2	ND	0.5	51	ND	0.5	0.5	--
Xylenes (Total)	µg/L	1	ND	0.5	5	ND	0.5	2	ND	0.5	1	ND	0.5	1	ND	0.5	1750	--

Table C-3 Summary of 2020 Volatile Organic Compound (VOC) Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]

Notes:

Table includes data for wells monitored by Valley Water (annual monitoring network wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).

Only wells with known construction information are presented. Unless construction is known, DDW wells are assumed to represent the principal zone, as these are typically deep wells.

1. µg/L = micrograms per liter ; ng/L = nanograms per liter.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. ND= not detected above laboratory reporting limit in any samples. D = detection above reporting limit in one or more samples (see Table C-4 for more information).
6. RL = Laboratory reporting limit. In the case of multiple reporting limits, the highest limit is shown. NA is shown if the reporting limit is not available.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA.

Table C-4 Summary of 2020 Volatile Organic Compounds (VOCs) Detections

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain								Santa Clara Subbasin, Coyote Valley				Llagas Subbasin								Maximum Contaminant Level	
		Shallow Zone[2]				Principal Zone[3]								Shallow Zone				Principal Zone					
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
1,1,1-Trichloroethane	µg/L	1	0.9	0.9	0.9	90	<0.5	<0.5	1.1	5	<0.5	<0.5	<0.5	2	<0.5	<0.5	<0.5	51	<0.5	<0.5	<0.5	200	--
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	µg/L	1	<10	<10	<10	90	<10	<10	2.8	5	<10	<10	<10	2	<2	<2	<2	51	<2	<10	<10	1,200	--
1,1-Dichloroethene	µg/L	1	<0.5	<0.5	<0.5	90	<0.5	<0.5	0.83	5	<0.5	<0.5	<0.5	2	<0.5	<0.5	<0.5	51	<0.5	<0.5	<0.5	6	--
Bromodichloromethane (THM)	µg/L	1	<1	<1	<1	22	<1	<1	1.5	2	<1	<1	<1	2	<0.5	<0.5	<0.5	4	<0.5	<1	<1	--	--
Chloroform (THM)	µg/L	1	<1	<1	<1	22	<1	<1	42.01	2	<1	<1	<1	2	<0.5	<0.5	<0.5	4	<0.5	<1	<1	--	--
Dichloroacetic Acid (DCAA)	µg/L	--	--	--	--	1	33	33	33	--	--	--	--	2	<0.2	<1	<1	2	<0.2	<1	<1	--	--
Haloacetic Acids (HAA5)	µg/L	--	--	--	--	1	44.6	44.6	44.6	--	--	--	--	2	<0.2	<1	<1	2	<0.2	<1	<1	60	--
Perfluorobutanesulfonic acid (PFBS)	ng/L	13	<0.002	0.86	9.27	204	<0.002	0.94	4.02	7	<0.002	<0.002	2.48	9	<0.002	<0.002	0	7	<0.002	<2	<2	--	--
Perfluoroheptanoic acid (PFHPA)	ng/L	13	<0.002	<0.002	0.0027	204	<0.002	0.29	2	7	<0.002	<0.002	<2	9	<0.002	<0.002	<2	7	<0.002	<2	<2	--	--
Perfluorohexane Sulfonic Acid (PFHxS)	ng/L	13	<0.002	0.0055	13.52	204	<0.002	1.86	7.55	7	<0.002	<0.002	<2	9	<0.002	<0.002	<2	7	<0.002	0.6011	2.4	--	--
Perfluorohexanoic Acid (PFHxA)	ng/L	13	<0.002	<0.002	2.14	204	<3	0.44	2.9	7	<0.002	<0.002	<2	9	<0.002	<0.002	4.26	7	<0.002	<0.002	4.32	--	--
Perfluorononanoic acid (PFNA)	ng/L	13	<0.002	<0.002	0.0024	204	<0.002	0.62	4.96	7	<0.002	<0.002	<2	9	<0.002	<0.002	<2	7	<0.002	<2	<2	--	--
Perfluorooctanoic Acid (PFOA)	ng/L	13	<0.002	<0.002	3.93	205	<0.002	0.54	4	7	<0.002	<0.002	<2	9	<0.002	<0.002	7.84	7	<0.002	<0.002	7.35	--	--
Perfluorooctanesulfonic acid (PFOS)	ng/L	13	<0.002	1.88	20.74	205	<0.002	1.7	9.9	7	<0.002	<0.002	2.31	9	<0.002	<0.002	2.6	7	<0.002	<0.002	5.72	--	--
Tetrachloroethene	µg/L	1	<0.5	<0.5	<0.5	90	<0.5	<0.5	<0.5	5	<0.5	<0.5	<0.5	2	<0.5	<0.5	<0.5	51	<0.5	<0.5	1.6	5	--
Total Trihalomethanes	µg/L	1	<0.5	<0.5	<0.5	6	<0.5	<0.5	43.51	2	<0.5	<0.5	<0.5	1	<0.5	<0.5	<0.5	1	<0.5	<0.5	<0.5	80	--
Trichloroacetic Acid (TCAA)	µg/L	--	--	--	--	1	11.6	11.6	11.6	--	--	--	--	2	<0.5	<1	<1	2	<0.5	<1	<1	--	--

Notes:

Table includes data for wells monitored by Valley Water (annual monitoring network wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW). The table does not include results from wells sampled near recycled water irrigation sites, which are included in Appendix E.

Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1. µg/L = micrograms per liter ; ng/L = nanograms per liter.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when there are no quantified values at the lowest reporting limit.
6. For parameters with results with multiple reporting limits, the median was computed using the Maximum Likelihood Estimate method.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA.

Table C-5 Summary of 2020 Pesticide Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
2,3,7,8-TCDD (Dioxin)	µg/L	--	--	--	205	ND	0.000005	7	ND	0.000005	--	--	--	7	ND	0.000005	0.00003	--
2,4,5-TP (Silvex)	µg/L	--	--	--	205	ND	1	7	ND	1	--	--	--	9	ND	1	50	--
2,4-D	µg/L	--	--	--	205	ND	10	7	ND	10	--	--	--	9	ND	10	70	--
3-Hydroxycarbofuran	µg/L	--	--	--	37	ND	3	4	ND	3	--	--	--	1	ND	3	--	--
Aciflurfen	µg/L	--	--	--	3	ND	0.5	--	--	--	--	--	--	--	--	--	--	--
Alachlor	µg/L	--	--	--	209	ND	1	7	ND	1	--	--	--	9	ND	1	2	--
Aldicarb	µg/L	--	--	--	37	ND	3	4	ND	3	--	--	--	1	ND	3	--	--
Aldicarb Sulfone	µg/L	--	--	--	37	ND	4	4	ND	4	--	--	--	1	ND	4	--	--
Aldicarb Sulfoxide	µg/L	--	--	--	37	ND	3	4	ND	3	--	--	--	1	ND	3	--	--
Aldrin	µg/L	--	--	--	37	ND	0.075	5	ND	0.075	--	--	--	1	ND	0.075	--	--
Atrazine	µg/L	--	--	--	205	ND	0.5	9	ND	0.5	--	--	--	9	ND	0.5	1	--
Bentazon	µg/L	--	--	--	205	ND	2	7	ND	2	--	--	--	9	ND	2	18	--
Bromacil	µg/L	--	--	--	34	ND	10	4	ND	10	--	--	--	--	--	--	--	--
Butachlor	µg/L	--	--	--	34	ND	0.38	4	ND	0.38	--	--	--	--	--	--	--	--
Carbaryl	µg/L	--	--	--	37	ND	5	4	ND	5	--	--	--	1	ND	5	--	--
Carbofuran	µg/L	--	--	--	205	ND	5	7	ND	5	--	--	--	10	ND	5	18	--
Chlordane	µg/L	--	--	--	205	ND	0.1	8	ND	0.1	--	--	--	9	ND	0.1	0.1	--
Dalapon	µg/L	--	--	--	205	ND	10	7	ND	10	--	--	--	9	ND	10	200	--
DCPA (Total Di & Mono Acid Degradates)	µg/L	--	--	--	34	**D**	0.1	4	ND	0.1	--	--	--	--	--	--	--	--
Diazinon	µg/L	--	--	--	34	ND	0.1	4	ND	0.1	--	--	--	--	--	--	--	--
Dicamba	µg/L	--	--	--	63	ND	1.5	4	ND	1.5	--	--	--	1	ND	1.5	--	--
Dieldrin	µg/L	--	--	--	37	ND	0.02	5	ND	0.02	--	--	--	1	ND	0.02	--	--
Dimethoate	µg/L	--	--	--	34	ND	0.1	4	ND	0.1	--	--	--	--	--	--	--	--
Dinoseb	µg/L	--	--	--	205	ND	2	7	ND	2	--	--	--	9	ND	2	7	--
Diquat	µg/L	--	--	--	205	ND	4	5	ND	4	--	--	--	10	ND	4	20	--
Endothall	µg/L	--	--	--	205	ND	45	7	ND	45	--	--	--	10	ND	45	100	--
Endrin	µg/L	--	--	--	205	ND	0.1	8	ND	0.1	--	--	--	9	ND	0.1	2	--
gamma-BHC (lindane)	µg/L	--	--	--	209	ND	0.2	8	ND	0.2	--	--	--	9	ND	0.2	0.2	--
Glyphosate	µg/L	--	--	--	205	ND	25	7	ND	25	--	--	--	9	ND	25	700	--
Heptachlor	µg/L	--	--	--	205	ND	0.01	8	ND	0.01	--	--	--	9	ND	0.01	0.01	--
Heptachlor Epoxide	µg/L	--	--	--	205	ND	0.01	8	ND	0.01	--	--	--	9	ND	0.01	0.01	--
Hexachlorobenzene	µg/L	--	--	--	205	ND	0.5	8	ND	0.5	--	--	--	9	ND	0.5	1	--

Table C-5 Summary of 2020 Pesticide Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
Hexachlorocyclopentadiene	µg/L	--	--	--	205	ND	1	8	ND	1	--	--	--	9	ND	1	50	--
Methiocarb	µg/L	--	--	--	37	ND	0.5	4	ND	0.5	--	--	--	--	--	--	--	--
Methomyl	µg/L	--	--	--	37	ND	2	4	ND	2	--	--	--	1	ND	2	--	--
Methoxychlor	µg/L	--	--	--	209	ND	10	8	ND	10	--	--	--	9	ND	10	30	--
Metolachlor	µg/L	--	--	--	34	ND	0.05	4	ND	0.05	--	--	--	--	--	--	--	--
Metribuzin	µg/L	--	--	--	34	ND	0.05	4	ND	0.05	--	--	--	--	--	--	--	--
Molinate	µg/L	--	--	--	205	ND	2	7	ND	2	--	--	--	8	ND	2	20	--
Oxamyl	µg/L	--	--	--	205	ND	20	7	ND	20	--	--	--	10	ND	20	50	--
Pentachlorophenol	µg/L	--	--	--	205	ND	0.2	7	ND	0.2	--	--	--	9	ND	0.2	1	--
Picloram	µg/L	--	--	--	205	ND	0.1	7	ND	1	--	--	--	9	ND	1	500	--
Propachlor	µg/L	--	--	--	34	ND	0.5	4	ND	0.5	--	--	--	--	--	--	--	--
Propoxur	µg/L	--	--	--	37	ND	0.5	4	ND	0.5	--	--	--	--	--	--	--	--
Simazine	µg/L	--	--	--	205	ND	1	9	ND	1	--	--	--	9	ND	1	4	--
Terbuthylazine	µg/L	--	--	--	--	--	--	--	--	--	2	ND	--	2	ND	0.1	--	--
Thiobencarb	µg/L	--	--	--	207	ND	1	7	ND	1	--	--	--	8	ND	1	70	1
Toxaphene	µg/L	--	--	--	205	ND	1	8	ND	1	--	--	--	9	ND	1	3	--

Notes:

Table includes data for wells monitored by Valley Water (annual monitoring network wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).

Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1. µg/L = micrograms per liter.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. ND= not detected above laboratory reporting limit in any samples.
6. RL = Laboratory reporting limit. In the case of multiple reporting limits, the highest limit is shown. NA is shown if the reporting limit is not available.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA

Table C-6 Summary of 2020 Pesticide Detections

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain								Santa Clara Subbasin, Coyote Valley				Llagas Subbasin								Maximum Contaminant Level	
		Shallow Zone[2]				Principal Zone[3]								Shallow Zone				Principal Zone					
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
DCPA (Total Di & Mono Acid Degradates)	µg/L	--	--	--	--	34	<0.1	<0.1	0.72	4	<0.1	<0.1	<0.1	--	--	--	--	--	--	--	--	--	--

Notes:
No pesticides were detected at concentrations above respective method reporting limits.
Table includes data for wells monitored by Valley Water (annual monitoring network wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).
Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1. µg/L = micrograms per liter.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <0.1) is shown when there are no quantified values at the lowest reporting limit.
6. For parameters with results with multiple reporting limits, the median was computed using the Maximum Likelihood Estimate method.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA.

Table C-7 Summary of 2020 Radioactive Data

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain								Santa Clara Subbasin, Coyote Valley				Llagas Subbasin								Maximum Contaminant Levels	
		Shallow Zone[2]				Principal Zone[3]								Shallow Zone				Principal Zone					
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
Combined Radium 226 + 228	pCi/L	--	--	--	--	7	<2	<2	<2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gross Alpha	pCi/L	--	--	--	--	34	<3	1.7	5.6	--	--	--	--	--	--	--	--	6	0.054	1.29	3.99	15	--
Gross Beta	pCi/L	--	--	--	--	4	<4	<4	<4	--	--	--	--	--	--	--	--	--	--	--	--	50	--
Radium 226	pCi/L	--	--	--	--	10	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Radium 228	pCi/L	--	--	--	--	10	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Uranium	pCi/L	--	--	--	--	10	<1	1.1	1.3	--	--	--	--	--	--	--	--	1	<1	<1	<1	20	--

Notes:

Table includes data for wells monitored by Valley Water (annual monitoring network wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).

Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1. pCi/L = picocuries per liter.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when there are no quantified values at the lowest reporting limit.
6. For parameters with results with multiple reporting limits, the median was computed using the Maximum Likelihood Estimate (MLE) method.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA.

APPENDIX D

2020 Water Quality Evaluation at Recycled Water Irrigation Sites

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2020 Water Quality Evaluation at Recycled Water Irrigation Sites

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Groundwater Management Unit

August 2021

Monitoring Near Recycled Water Irrigation Sites

Valley Water partners with the four recycled water producers[1] in Santa Clara County to provide tertiary-treated disinfected recycled water (recycled water) for non-potable purposes such as landscape irrigation, agricultural irrigation, and industrial uses. Recycled water used in Santa Clara County generally has higher concentrations of salts, nutrients, disinfection byproducts, and emerging contaminants than local groundwater or imported water.[2] Previous studies have shown that some contaminants in recycled water can migrate to shallow groundwater as a result of recycled water irrigation.[3,4] To ensure groundwater resources remain protected as recycled water use expands, Valley Water monitors numerous sites in the Llagas Subbasin where recycled water is provided by the South County Regional Wastewater Authority (SCRWA). Valley Water also receives groundwater data from SBWR, which monitors groundwater near sites irrigated with recycled water in the Santa Clara Subbasin. If evidence shows that recycled water irrigation is adversely affecting groundwater, actions may be taken to mitigate the deleterious effects.

The 2020 recycled water sampling events are summarized in Table D-1 and monitoring locations are shown in Figures D-1 and D-2. Geochemical evaluations and statistical analyses of long-term concentration trends are used to evaluate water quality impacts of recycled water irrigation and are summarized below for the Santa Clara Plain (there is no recycled water irrigation in Coyote Valley) and the Llagas Subbasin.

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[1] Recycled water is produced at the Palo Alto Regional Wastewater Quality Control Plant (PARWQCP), the Sunnyvale Water Pollution Control Plant (SWPCP), the San Jose/Santa Clara Regional Wastewater Facility (SJSCRWF), and the South County Regional Wastewater Authority (SCRWA). The branch of the SJSCRWF that produces recycled water is referred to as South Bay Water Recycling (SBWR).

[2] *Advanced Recycled Water Treatment Facility Project*. Black & Veatch and Kennedy/Jenks for the Santa Clara Valley Water District. August, 2003.

[3] *Fate and Transport of Wastewater Indicators: Results from the Ambient Groundwater and from Groundwater Directly Influenced by Wastewater*. California GAMA Program, Lawrence Livermore National Laboratory and California State Water Resources Control Board. June, 2006.

[4] *Recycled Water Irrigation and Groundwater Study: Santa Clara and Llagas Groundwater Subbasins*. Locus Technologies for Valley Water. August, 2011.

Table D-1. Summary of 2020 Groundwater Monitoring Events near Recycled Water Irrigation Sites

Subbasin	Location	Sampling Agency	Sampling Summary
Santa Clara Subbasin (Santa Clara Plain)	Various Locations in San Jose	South Bay Water Recycling (SBWR)	• Groundwater from five shallow wells and four deep wells was monitored in February through April 2020 by the City of San Jose per their Groundwater Mitigation and Monitoring Plan (GMMP).
Llagas Subbasin	Christmas Hill Park, Gilroy	Valley Water	• Groundwater from three shallow wells was sampled in June and October 2020. • Recycled water delivered to this site was sampled in June and October 2020.
	Irrigated Land Near SCRWA Plant, Gilroy	Valley Water	• Groundwater from three shallow wells and one deep well was sampled in June and October 2020 • Recycled water delivered to the site from the SCRWA plant was sampled in June and October 2020
	Irrigated Land Along Expanded Recycled Water Pipelines (West Gilroy)	Valley Water	• Groundwater from 12 shallow monitoring wells was sampled in June 2020 and groundwater from 11 shallow wells (one well was dry) was sampled in October 2020.

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Figure D-1. Groundwater Monitoring Near Santa Clara Subbasin Recycled Water Irrigation Sites

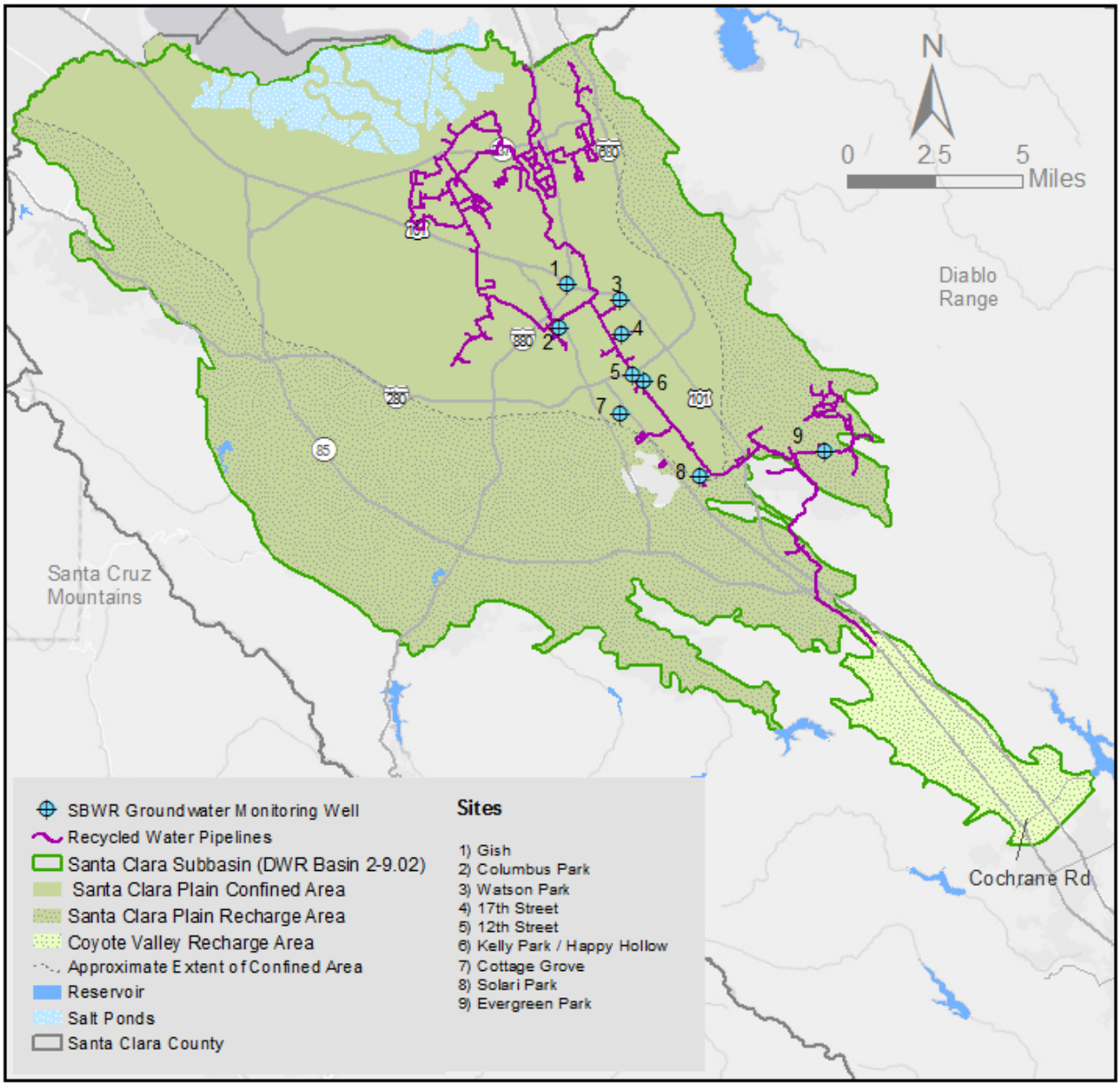
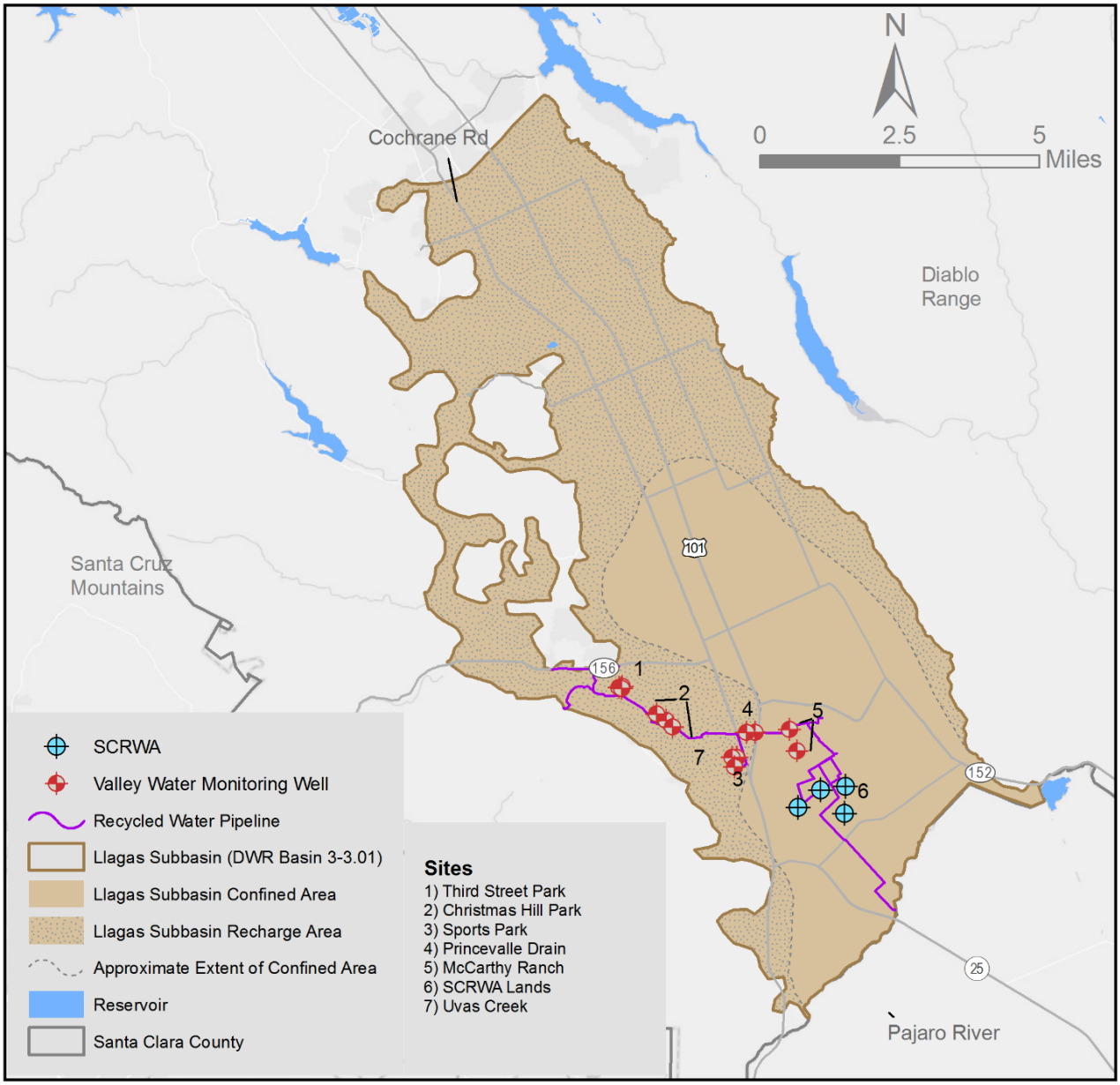


Figure D-2. Groundwater Monitoring Near Llagas Subbasin Recycled Water Irrigation Sites



Santa Clara Subbasin

SBWR developed a Groundwater Monitoring and Mitigation Program (GMMP) to meet the terms of the 1997 Environmental Impact Report (EIR) for the SBWR system expansion.[5] SBWR has monitored groundwater wells in areas near recycled water irrigation since 1997. The groundwater wells monitored by SBWR consist of four (previously six; two wells were destroyed in 2018) deep groundwater supply

[5] *GMMP EIR*. Harding Lawson Associates for the City of San Jose. 1997

wells and five (previously six, one well was recently decommissioned) shallow groundwater monitoring wells (Figure D-1). These nine wells are referred to as "GMMP wells." The shallow wells range in depth from 38 to 64 feet below ground surface while the deep wells all have depths of greater than 600 feet with multiple perforated intervals. The primary parameters of concern identified in the EIR were salts (measured as TDS) and nitrate; hence, the list of monitoring parameters for the GMMP wells is less extensive than the list of monitoring parameters used by Valley Water for the South County wells (described under Llagas Subbasin section). The GMMP does not include analyses for wastewater indicators such as PFAS or nitrosamines, making it more challenging to assess recycled water impacts to groundwater.

Valley Water and SBWR have worked to improve recycled water quality for irrigation and other purposes. Since March 2014, recycled water provided by SBWR has been blended with advanced treated water from Valley Water's Silicon Valley Advanced Water Purification Center, which produces up to eight million gallons of water a day. The final, blended recycled water quality is improved, with TDS lowered from about 750 mg/L to about 500 - 550 mg/L.

Concentration Trends

An analysis of long-term concentration trends was performed to evaluate water quality impacts of recycled water irrigation using the Mann-Kendall test which does not require any assumptions as to the statistical distribution of the data (e.g., normal, lognormal, etc.) and allows for irregularly spaced measurement periods (i.e. variable sampling intervals).[6] The Mann-Kendall test was performed separately for the North County wells and the South County wells; data for the North County wells are summarized in Table 2.

Concentration trend results for the GMMP wells show stable or decreasing concentrations for most parameters with the exception of calcium, chloride, and magnesium (Table D-2). It is likely that increasing concentration trends in the deep wells were established before the advent of recycled water irrigation. Increasing concentrations in the deep aquifer zone within the interior portion of the basin are more likely the result of contaminants moving along longer flow paths originating in the forebay zone rather than vertical migration. Increasing trends seen in the shallow wells may be due to recycled water irrigation but may also be due to other factors such as lateral movement from the recharge area into the interior of the Santa Clara Plain. The lack of data collection of wastewater indicators makes it more difficult to determine the role recycled water irrigation plays in these upward trends seen in the GMMP wells.

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[6] *Appendix A.2.: Statistical Trends Analysis Methods.* GSI and Air Force Center for Environmental Excellence. February 2007.

Table D-2. Groundwater Concentration Trends at Santa Clara Plain Recycled Water Irrigation Sites

Parameter	Number of Wells with Increasing Concentrations	Number of Wells with Stable Concentrations	Number of Wells with Decreasing Concentrations
Bicarbonate	1	5	3
Calcium	7	1	1
Chloride	5	4	0
Magnesium	5	2	2
Nitrate	3	2	4
Potassium	4	3	2
Sodium	4	4	1
Sulfate	4	2	3
Total Dissolved Solids (TDS)	4	3	2

Geochemical Analyses

Geochemical analyses were completed using Piper Diagrams, a graphical tool for understanding sources of dissolved parameters in water, water quality trends over time, and whether mixing between two water sources has occurred. Piper Diagram analysis suggests that mixing between groundwater and recycled water is not evident in samples collected from three of the deep wells in 2020 (Figure D-3). Results for samples collected from one of the deep wells (Gish) and the five shallow wells in 2020 are inconclusive and suggest multiple geochemical processes are in progress, including the possibility of recycled water mixing with groundwater (Figure D-3).

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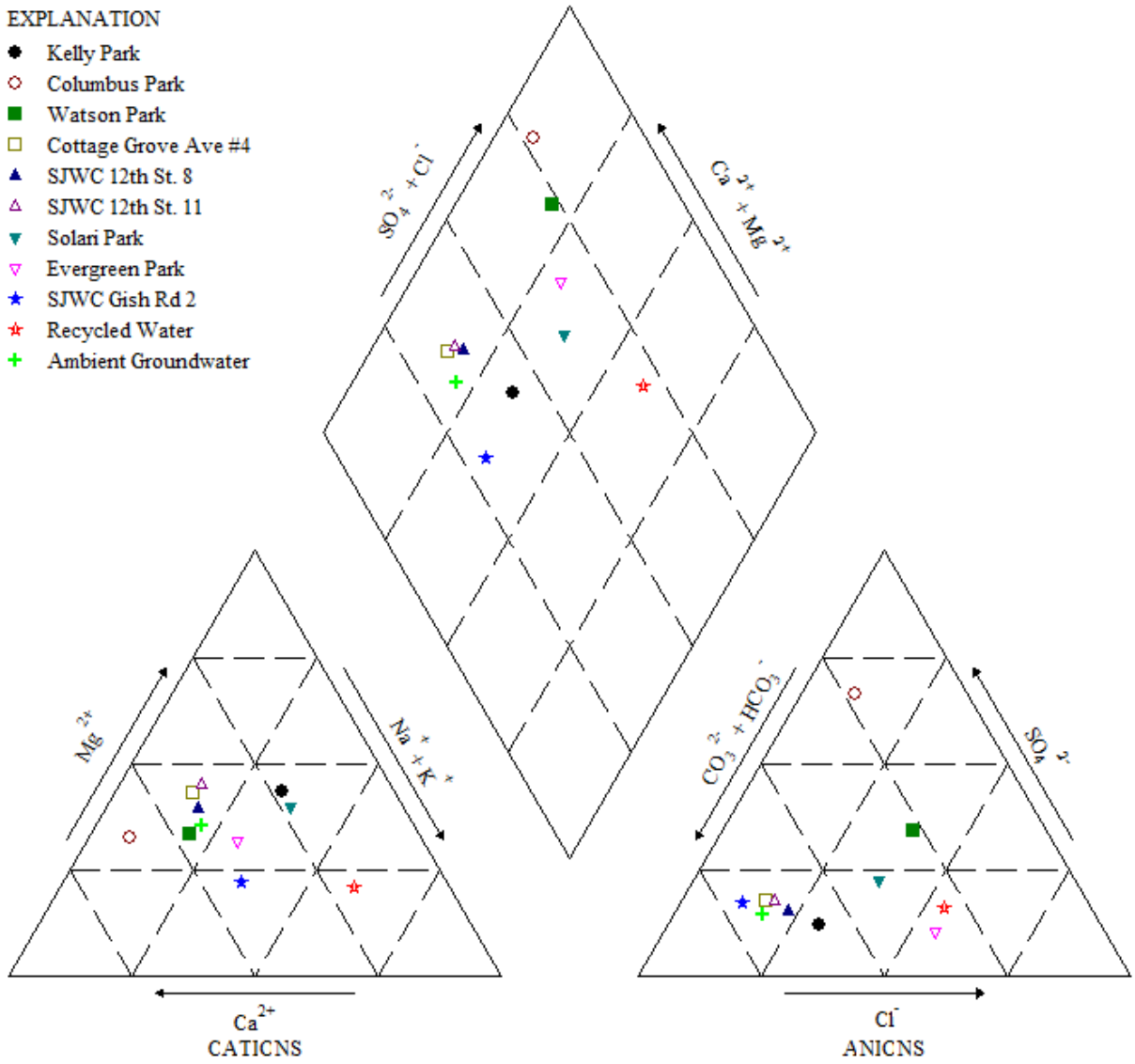
Figure D-3. Piper Diagram for Santa Clara Subbasin Groundwater Monitoring Wells Near Recycled Water Irrigation Sites



Llagas Subbasin

To support expanded recycled water use per the *South County Recycled Water Master Plan*[7] and to comply with the terms of the *Final Program EIR for the South County Recycled Water Master Plan*[8], Valley Water developed the *South Santa Clara County Recycled Water/Groundwater Monitoring Plan* (RW Monitoring Plan) in 2012 and began collecting samples from a group of groundwater monitoring

[7] *South County Recycled Water Master Plan.* Carollo Engineers for Valley Water and South County Regional Wastewater Authority. October, 2004.
[8] *Final Program EIR for the South County Recycled Water Master Plan.* Valley Water. March, 2011.

wells located along the SCRWA pipelines and at the SCRWA facility.[9] Additional groundwater monitoring wells were added to the RW Monitoring Plan as SCRWA expanded its recycled water system; all wells monitored by Valley Water as part of the RW Monitoring Plan are referred to as "South County wells" (Figure D-2). Valley Water analyzes South County well water samples for basic water quality parameters, disinfection by-products, nitrosamines, PFAS, and other parameters commonly encountered in recycled water.

Wastewater Indicators

Four of the South County wells are located near the SCRWA facility. These four wells (three shallow wells and one deep well) are near farmlands irrigated with recycled water and are also near sludge-drying ponds that receive secondary effluent produced at the SCRWA facility. Nitrosamines and PFAS have been more frequently detected, and at higher concentrations, in the four wells near the SCRWA facility than in other South County wells. This suggests an impact of recycled water, secondary effluent from the sludge-drying ponds, or both, on groundwater near the SCRWA facility.

Two PFAS measured in the South County wells, perfluorooctanoic acid (PFOA) and perfluorooctanesulfonate (PFOS), have notification levels (NLs) that have been set by the California State Water Resources Control Board at 5.1 nanograms per liter (ng/L) for PFOA and 6.5 ng/L for PFOS.[10] The NLs for PFOA and PFOS apply only to water used for drinking; while water from the South County wells is not used for drinking, the NLs provide a useful reference point with which to compare PFOA and PFOS levels. In 2020 PFOA was detected above the NL in nine South County monitoring wells, four of which are located at the SCRWA facility. The median value for PFOA for all South County wells is non-detect (i.e. less than 2 ng/L). However, the median value for PFOA for the nine wells in which it was detected above the NL is 16 ng/L, considerably higher than the NL for PFOA. The four monitoring wells located at the SCRWA facility have the highest levels of PFOA, ranging from 14 ng/L to 40 ng/L.

In 2020 PFOS was detected above the NL in six South County wells, four of which are wells located at the SCRWA facility. While the median value for PFOS for all South County wells is non-detect (i.e. less than 2 ng/L), the median value for PFOS for the six wells in which it was detected above the NL is 50 ng/L. This is significantly above the NL and higher than the response level (RL) of 40 ng/L. The four monitoring wells located at the SCRWA facility have the highest levels of PFOS, ranging from 13 to 106 ng/L.

In 2020 Valley Water switched to using a new method for PFAS analysis (EPA Method 537.1) of samples from the South County wells, a method that detects 18 PFAS (rather than the three PFAS previously measured, PFOA, PFOS, and PFBA). So far, data gathered in 2020 indicate the frequent[11] presence of several PFAS including PFBS, PFHxS, PFHxA, PFHpA, PFNA, and PFDA[12] in the South County wells; however, most detections of these PFAS are only slightly higher than the method reporting limit (generally 2 ng/L). PFBS has a NL of 500 ng/L (0.5 parts per billion) while the other PFAS do not have notification levels. In general, short-chain PFAS (those PFAS with 6 carbons or less) were detected more

---

[9] *South Santa Clara County Recycled Water/Groundwater Monitoring Plan*. Valley Water. June, 2012.

[10] https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/PFOA_PFOS.html

[11] The term "frequent" refers to PFAS that were detected in 25% or more of wells in which the PFAS was measured.

[12] PFBS = Perfluorobutanesulfonic Acid; PFHxS = Perfluorohexanesulfonic Acid; PFHxA = Perfluorohexanoic Acid; PFHpA = Perfluoroheptanoic Acid; PFNA = Perfluorononanoic Acid; PFDA = Perfluorodecanoic Acid.

frequently than long-chain PFAS. Once several years' worth of data are collected using EPA Method 537.1, concentration trends can be analyzed for additional PFAS besides PFOA and PFOS[13].

While PFOA and PFOS have been consistently detected in South County wells over the years, these parameters have not been regularly measured as part of other Valley Water groundwater monitoring programs. In 2020 Valley Water conducted regional PFAS sampling of 55 regional groundwater monitoring wells; in general, levels of PFOA and PFOS in the 55 regional monitoring wells are lower than those detected in the South County wells (see section 5.6 for more details).

In 2020 N-Nitrosodimethylamine (NDMA) was detected in recycled water from SCRWA at levels ranging from 2.3 to 3.9 ng/L; these values are only slightly above the detection limit of 2 ng/L. NDMA was not detected in any South County wells in 2020 though NDMA has been periodically detected at South County wells in the past. For a point of reference, the NL for NDMA for drinking water is 10 ng/L.

While not specifically a recycled water or wastewater indicator, TDS values are generally higher in recycled water (and wastewater) than in local groundwater; the median TDS value for 2020 for recycled water produced by SCRWA is 740 mg/L while the regional TDS for 2020 for local groundwater from the Llagas Subbasin is 398 mg/L (for the shallow aquifer). The four wells located onsite at SCRWA have a median TDS value of 670 mg/L which is significantly higher than the median for ambient groundwater in the Llagas Subbasin. This suggests an influence of secondary effluent from the sludge-drying ponds (at SCRWA) on TDS values in nearby wells.[14]

Concentration Trends

As was done for the North County wells, an analysis of long-term concentration trends was performed to evaluate water quality impacts of recycled water irrigation using the Mann-Kendall method.[15] Data for the South County wells are summarized in Table D-3.

The majority of South County wells show stable or decreasing trends for all parameters (Table D-3). Potassium, sodium, and sulfate have increasing trends for four, five, and four wells, respectively (Table D-3). Most of the South County wells with increasing concentration trends are either located at the SCRWA facility or at Christmas Hill Park in Gilroy, which was one of the first sites to receive recycled water from SCRWA for irrigation (recycled water irrigation at Christmas Hill Park began in 2003). It is possible that these increasing concentration trends at Christmas Hill Park are due to recycled water irrigation; however, as noted below, geochemical analyses suggest that ionic composition of the three Christmas Hill Park wells is more similar to local groundwater than to recycled water.

---

[13] PFBA was formerly measured for the South County wells; however, the analytes measured as part of EPA Method 537.1 does not include PFBA so this PFAS will no longer be analyzed

[14] It is possible that nearby recycled water irrigation is contributing to elevated TDS in the four wells located onsite at SCRWA; however, other South County wells tend to have lower TDS values than the four SCRWA wells, suggesting that the secondary effluent from the sludge-drying ponds likely plays a role.

[15] *Appendix A.2.: Statistical Trends Analysis Methods.* GSI and Air Force Center for Environmental Excellence. February 2007.

Table D-3. Groundwater Concentration Trends at Llagas Subbasin Recycled Water Irrigation Sites

Parameter	Number of Wells with Increasing Concentrations	Number of Wells with Stable Concentrations	Number of Wells with Decreasing Concentrations
Bicarbonate	1	15	3
Bromide	1	14	4
Calcium	1	17	1
Chloride	3	14	2
Magnesium	2	16	1
Nitrate	1	16	2
N-Nitrosodimethylamine (NDBA)	0	19	0
N-Nitrosodi-n-Butylamine (NDMA)	2	17	0
Perfluorooctanoic acid (PFOA)	0	17	2
Perfluorooctane Sulfonate (PFOS)	0	12	7
Potassium	4	15	0
Sodium	5	14	0
Sulfate	4	15	0
Total Dissolved Solids (TDS)	0	18	1

Geochemical Analyses

Geochemical analyses completed using Piper Diagrams show that the ionic composition of the three shallow wells near the SCRWA facility is more similar to recycled water than to ambient groundwater (Figures D-4 and D-5) which could be due to recycled water irrigation on the nearby farmlands but could also be due to percolation of secondary effluent from the SCRWA sludge-drying ponds. Geochemical analyses of all other South County wells show ionic compositions more similar to local groundwater than to recycled water (Figure D-4) and do not appear to be changing significantly over time (based on Piper Diagram analyses for past Annual Reports).

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Figure D-4. Piper Diagram for Llagas Subbasin Groundwater Monitoring Wells Near Recycled Water Irrigation Sites: Christmas Hill Park, Sports Park, and 3rd St. Park Wells

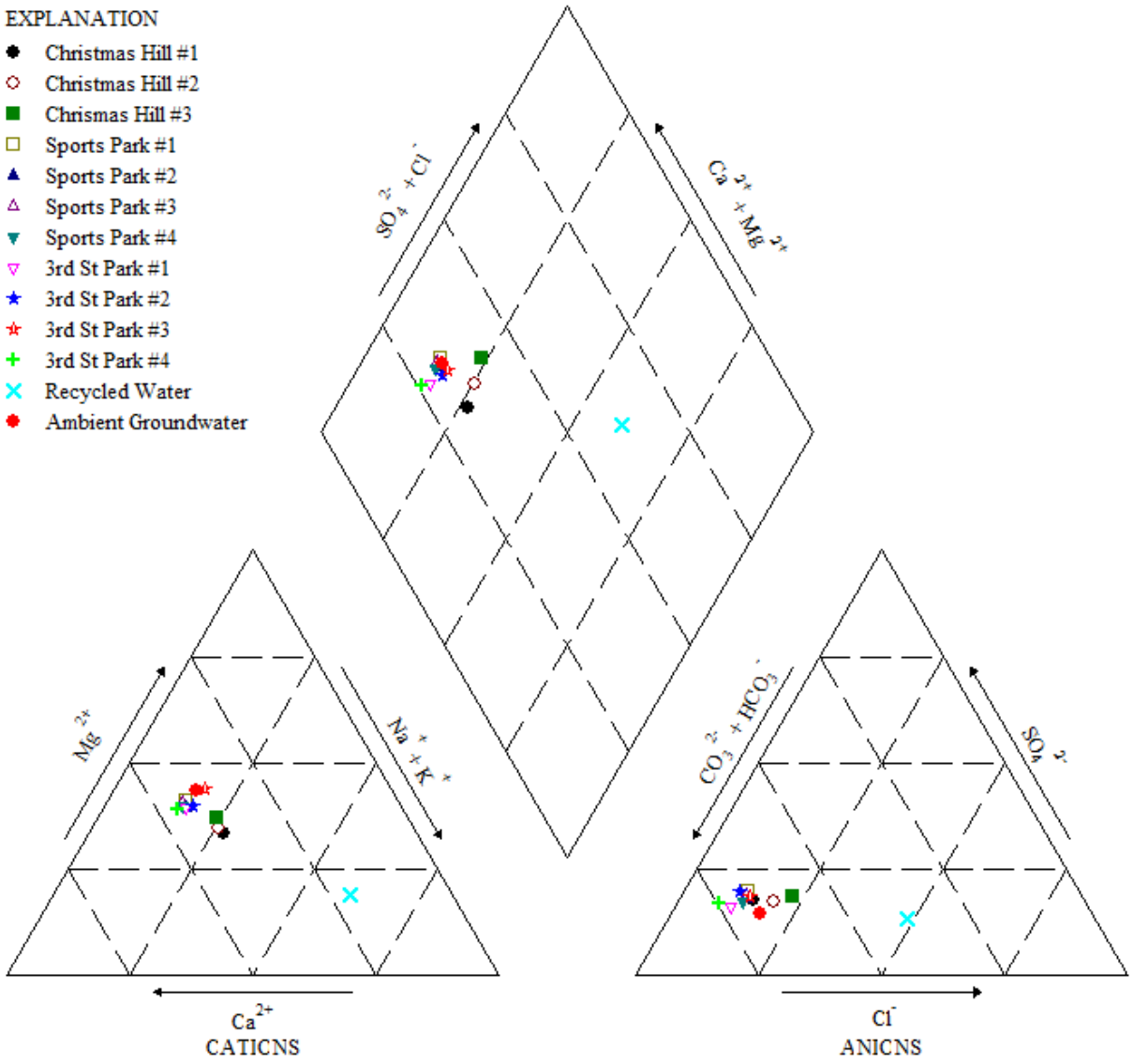

Figure D-5. Piper Diagram for Llagas Subbasin Groundwater Monitoring Wells Near Recycled Water Irrigation Sites: SCRWA and Other Nearby Wells

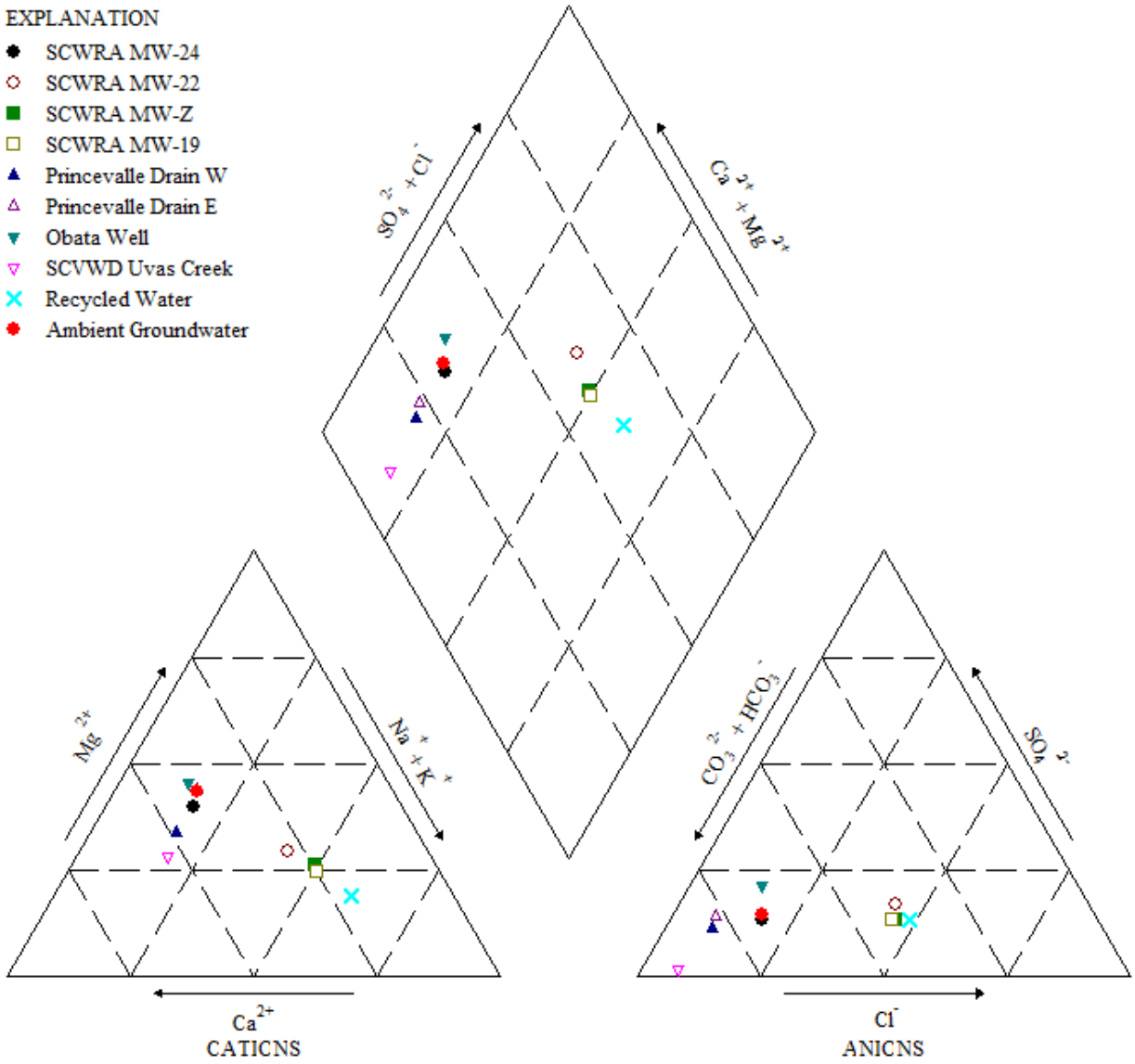

Table D-4 Summary of 2020 Santa Clara Subbasin Groundwater Monitoring Well Data (near sites of recycled water irrigation)

Parameter	Units	Santa Clara Subbasin, Santa Clara Plain				Maximum Contaminant Level	
		n	Min	Median	Max	MCL	SMCL
Major and Minor Ions							
Bicarbonate Alkalinity (as CaCO3)	mg/L	9	160	340	780	--	--
Calcium	mg/L	9	46	80	390	--	--
Chloride	mg/L	9	21	120	430	--	250
Magnesium	mg/L	9	15	52	180	--	--
Potassium	mg/L	9	<1	1.4	4	--	--
Sodium	mg/L	9	33	62	320	--	--
Sulfate	mg/L	9	39	72	920	--	250
Total Dissolved Solids (TDS)	mg/L	9	300	550	2200	--	500
Nutrients							
Nitrate (as N)	mg/L	9	<0.4	8.92	4.014	10	--
Trace Elements							
Boron	mg/L	9	<0.2	0.92	<0.2	--	--

Notes:

1. Table includes data for groundwater monitoring wells near areas irrigated with water from South Bay Water Recycling (SBWR)
2. n = number of results
3. MCL = Maximum Contaminant Level as specified in Title 22 of the California Code of Regulations
4. SMCL = Secondary Maximum Contaminant Level or aesthetic-based standard per DDW or US EPA
5. mg/L = milligrams per liter, µg/L = micrograms per liter; ng/L = nanograms per liter

Table D-5 Summary of 2020 Llagas Subbasin Groundwater Monitoring Well Inorganic Data (near sites of recycled water irrigation)

Parameter	Units	Llagas Subbasin				Maximum Contaminant Level	
		n	Min	Median	Max	MCL	SMCL
Major and Minor Ions							
Bromate	µg/L	18	<0.25	<0.25	<0.25	10	--
Bromide	mg/L	37	<0.1	<0.1	0.47	--	--
Calcium	mg/L	37	17.9	46.8	89.2	--	--
Calcium (as CaCO3)	mg/L	37	44.8	117	223	--	--
Chloride	mg/L	37	<5	26	192	--	250
Cyanide	mg/L	37	<0.025	<0.025	<0.025	0.15	--
Fluoride (natural source)	mg/L	37	<0.1	0.1	0.41	2	--
Magnesium	mg/L	37	7.5	25.3	58.5	--	--
Perchlorate	µg/L	37	<4	<4	<4	6	--
Potassium	mg/L	37	<0.5	1	2.3	--	--
Silica	mg/L	19	15.6	25.3	34.9	--	--
Sodium	mg/L	37	6.4	21.9	137	--	--
Sulfate	mg/L	37	4.4	44.3	104	--	250
Total Dissolved Solids (TDS)	mg/L	37	96	306	760	--	500
Nutrients							
Nitrate (as N)	mg/L	37	<0.1	1.6	19.9	10	--
Orthophosphate (as PO4)	mg/L	37	<0.1	<0.1	0.64	--	--
Trace Elements							
Aluminum	µg/L	37	<20	<20	84	1,000	200
Antimony	µg/L	37	<1	<1	<1	6	--
Arsenic	µg/L	37	<2	<2	<2	10	--
Barium	µg/L	37	37	86	470	1,000	--
Beryllium	µg/L	37	<1	<1	<1	4	--
Boron	µg/L	37	<50	98	332	--	--
Cadmium	µg/L	37	<1	<1	<1	5	--
Chromium	µg/L	37	<1	1	2.4	50	--
Cobalt	µg/L	19	<1	<1	3.9	--	--
Copper	µg/L	37	<1	<1	3.2	1,300	1,000
Iron	µg/L	37	<20	<20	250	--	300
Lead	µg/L	37	<1	<1	<1	15	--
Lithium	µg/L	19	<5	5.5	11	--	--
Manganese	µg/L	37	<1	<1	1450	--	50
Mercury	µg/L	37	<1	<1	<1	2	--
Molybdenum	µg/L	19	<1	<1	4.5	--	--
Nickel	µg/L	37	<1	1.8	20.7	100	--
Selenium	µg/L	37	<5	<5	<5	50	--
Silver	µg/L	37	<1	<1	<1	--	100
Thallium	µg/L	37	<1	<1	<1	2	--
Vanadium	µg/L	37	<1	1.1	4.8	--	--
Zinc	µg/L	37	<10	<10	<10	--	5,000

Notes:

1. Table includes data for groundwater monitoring wells near areas irrigated with water from South County Regional Wastewater Authority (SCRWA)
2. n = number of results
3. MCL = Maximum Contaminant Level as specified in Title 22 of the California Code of Regulations
4. SMCL = Secondary Maximum Contaminant Level or aesthetic-based standard per DDW or US EPA
5. mg/L = milligrams per liter, µg/L = micrograms per liter; ng/L = nanograms per liter

Table D-6 Summary of 2020 Llagas Subbasin Groundwater Monitoring Well Organic Data (near sites of recycled water irrigation)

Parameter	Units	Llagas Subbasin				Maximum Contaminant Level	
		n	Min	Median	Max	MCL	SMCL
11-chloroeicosafluoro-3-oxaundecane-sulfonic acid	ng/L	37	<2	<2	<4	--	--
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	ng/L	37	<2	<2	<4	--	--
9-chlorohexadecafluoro-3-oxanone-sulfonic acid	ng/L	37	<2	<2	<4	--	--
Bromochloroacetic Acid (BCAA)	µg/L	37	<0.3	<0.3	<1	--	--
Bromochloromethane	µg/L	37	<0.5	<0.5	<0.5	--	--
Bromodichloroacetic Acid (BDCAA)	µg/L	37	<0.5	<0.5	<1	--	--
Bromodichloromethane (THM)	µg/L	37	<0.5	<0.5	<0.5	--	--
Bromoform (THM)	µg/L	37	<0.5	<0.5	<0.5	--	--
Bromomethane	µg/L	37	<0.5	<0.5	<0.5	--	--
Dibromochloroacetic Acid (CDBAA)	µg/L	37	<0.3	<0.3	<2	--	--
Chloroform (THM)	µg/L	37	<0.5	<0.5	0.6	--	--
Dibromoacetic Acid (DBAA)	µg/L	37	<0.3	<0.3	<1	--	--
Dibromochloromethane (THM)	µg/L	37	<0.5	<0.5	<0.5	--	--
Dibromomethane	µg/L	37	<0.5	<0.5	<0.5	--	--
Dichloroacetic Acid (DCAA)	µg/L	37	<0.2	<0.2	<1	--	--
Haloacetic Acids (HAA5)	µg/L	37	<0.2	<0.2	<1	60	--
Monobromoacetic Acid (MBAA)	µg/L	37	<0.3	<0.3	<1	--	--
Monochloroacetic Acid (MCAA)	µg/L	37	<2	<2	<2	--	--
N-ethyl Perfluorooctanesulfonamidoacetic acid	ng/L	37	<2	<4	<4	--	--
N-methyl Perfluorooctanesulfonamidoacetic acid	ng/L	37	<2	<2	<4	--	--
n-Nitrosodiethylamine (NDEA)	ng/L	37	<2	<2	<2	--	--
n-Nitrosodimethylamine (NDMA)	ng/L	37	<2	<2	<2	--	--
n-Nitrosodi-n-Butylamine (NDBA)	ng/L	37	<2	<2	<2	--	--
n-Nitrosodi-n-Propylamine (NDPA)	ng/L	37	<2	<2	<2	--	--
n-Nitrosomethylethylamine (NMEA)	ng/L	37	<2	<2	<2	--	--
n-Nitrosopyrrolidine (NPYR)	ng/L	37	<2	<2	<2	--	--
perfluorobutanesulfonic acid (PFBS)	ng/L	37	<2	2.8	23.3	--	--
Perfluorodecanoic acid (PFDA)	ng/L	37	<2	<2	5.1	--	--
Perfluorododecanoic acid (PFDoA)	ng/L	37	<2	<2	<4	--	--
Perfluoroheptanoic acid (PFHPA)	ng/L	37	<2	<2	17.1	--	--
Perfluorohexane Sulfonic Acid (PFHxS)	ng/L	37	<2	<2	9.3	--	--
Perfluorohexanoic Acid (PFHxA)	ng/L	37	<2	2.2	47.6	--	--
Perfluorononanoic acid (PFNA)	ng/L	37	<2	<2	6.7	--	--
Perfluorooctanoic Acid (PFOA)	ng/L	37	<2	<2	49	--	--
Perfluorooctyl Sulfonate (PFOS)	ng/L	37	<2	2.4	105.9	--	--
Perfluorotetradecanoic acid (PFTA)	ng/L	37	<2	<2	<4	--	--
Perfluorotridecanoic acid (PFTrDA)	ng/L	37	<2	<2	<4	--	--
Perfluoroundecanoic acid (PFUnA)	ng/L	37	<2	<2	<4	--	--
Tribromoacetic Acid (TBAA)	µg/L	37	<2	<2	<4	--	--
Trichloroacetic Acid (TCAA)	µg/L	37	<0.5	<0.5	<1	--	--

Notes:

1. Table includes data for groundwater monitoring wells near areas irrigated with water from South County Regional Wastewater Authority (SCRWA)
2. n = number of results
3. MCL = Maximum Contaminant Level as specified in Title 22 of the California Code of Regulations
4. SMCL = Secondary Maximum Contaminant Level or aesthetic-based standard per DDW or US EPA
5. mg/L = milligrams per liter, µg/L = micrograms per liter; ng/L = nanograms per liter

APPENDIX E

Water Year 2020 Report for the Santa Clara and Llagas Subbasins

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March 2022

Water Year 2020 Report for the Santa Clara and Llagas Subbasins

Valley Water

Santa Clara Valley Water District

Water Year 2020 Report for the Santa Clara and Llagas Subbasins

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Executive Summary

EXECUTIVE SUMMARY

The Santa Clara Valley Water District (Valley Water) is the Groundwater Sustainability Agency for the Santa Clara and Llagas subbasins (Basins 2-9.02 and 3-3.01, respectively) in Santa Clara County, which are sustainably managed due to the comprehensive activities described in Valley Water's 2016 Groundwater Management Plan (Plan).[1] This Water Year 2020 Report for the Santa Clara and Llagas Subbasins provides information on groundwater conditions and management as required by the Sustainable Groundwater Management Act (SGMA).[2]

Having previously fully recovered to pre-drought conditions, groundwater elevation and storage remained in healthy condition through Water Year (WY) 2020.[3] Total groundwater pumping was 131,800 acre-feet (AF)[4], providing 44% of the water used by county residents and businesses. WY 2020 was a dry year but adequate surface water supplies were available to support 80,600 AF of managed recharge using local and imported surface water for groundwater replenishment. Treated water delivered by Valley Water (103,000 AF) and recycled water use (16,800 AF) also provided in-lieu recharge, and countywide water conservation programs reduced water demands by more than 75,000 AF. This comprehensive recharge continues to support a balanced long-term groundwater budget. During WY 2020, outflows exceeded inflows in the Santa Clara and Llagas subbasins, resulting in a net decrease in storage of 25,800 and 2,300 AF, respectively. However, groundwater storage in WY 2020 remained well within the "Normal" stage (e.g., no shortage response required) under Valley Water's Water Shortage Contingency Plan.

Valley Water continues to implement the comprehensive activities described in the Plan, including efforts to:

- Maintain existing conjunctive water management programs and evaluate opportunities for enhancement or increased efficiency.
- Continue to aggressively protect groundwater quality through Valley Water programs and collaboration with land use agencies, regulatory agencies, and basin stakeholders.
- Continue to incorporate groundwater sustainability planning in Valley Water planning efforts.
- Maintain adequate monitoring programs and modeling tools.
- Continue and enhance groundwater management partnerships with water retailers and land use agencies.

Valley Water will continue to sustainably manage the Santa Clara and Llagas subbasins as a central part of our mission to provide Silicon Valley safe, clean water for a healthy life, environment, and economy. Implementation of the Plan helps ensure continued sustainability in accordance with SGMA, the Santa Clara Valley Water District Act, and Valley Water Board policy to "aggressively protect groundwater from the threat of contamination and maintain and develop groundwater to optimize reliability and to minimize land subsidence and salt water intrusion."

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[1] This Plan was approved by the Department of Water Resources as an Alternative to a Groundwater Sustainability Plan. Per state requirements, an annual report must be submitted by April 1 of each year following Valley Water adoption of the Plan.
[2] A comprehensive calendar-year based Annual Groundwater Report with detailed information on groundwater levels, storage, land subsidence and groundwater quality conditions is available at: https://www.valleywater.org/groundwater
[3] October 1, 2019 through September 30, 2020
[4] All values presented in this report are based on best available data (measured and/or estimated) and may be refined as additional data becomes available.

CHAPTER 1 – INTRODUCTION

For over 90 years, Valley Water has managed groundwater in Santa Clara County under the Santa Clara Valley Water District Act.[5] In December 2016, Valley Water submitted its Board-adopted 2016 Groundwater Management Plan (Plan)[6] to the Department of Water Resources (DWR) as an Alternative to a Groundwater Sustainability Plan under SGMA, and DWR approved the Plan in July 2019. Valley Water's comprehensive groundwater management programs and investments described in the Plan have resulted in sustainable groundwater conditions for many decades and will ensure groundwater resources are sustainable into the future.

Under the California Code of Regulations Title 23, Division 2, Chapter 1.5, Subchapter 2, Article 7, §356.2, each agency shall submit an annual report to DWR by April 1 of each year following adoption of the Plan. This report for Water Year (WY) 2020 is the fourth annual report submitted to DWR. It covers the Santa Clara Subbasin (DWR Basin 2-9.02) and the Llagas Subbasin (Basin 3-3.01), which are managed in their entirety by Valley Water. Figure 1 shows the location of the two groundwater subbasins.

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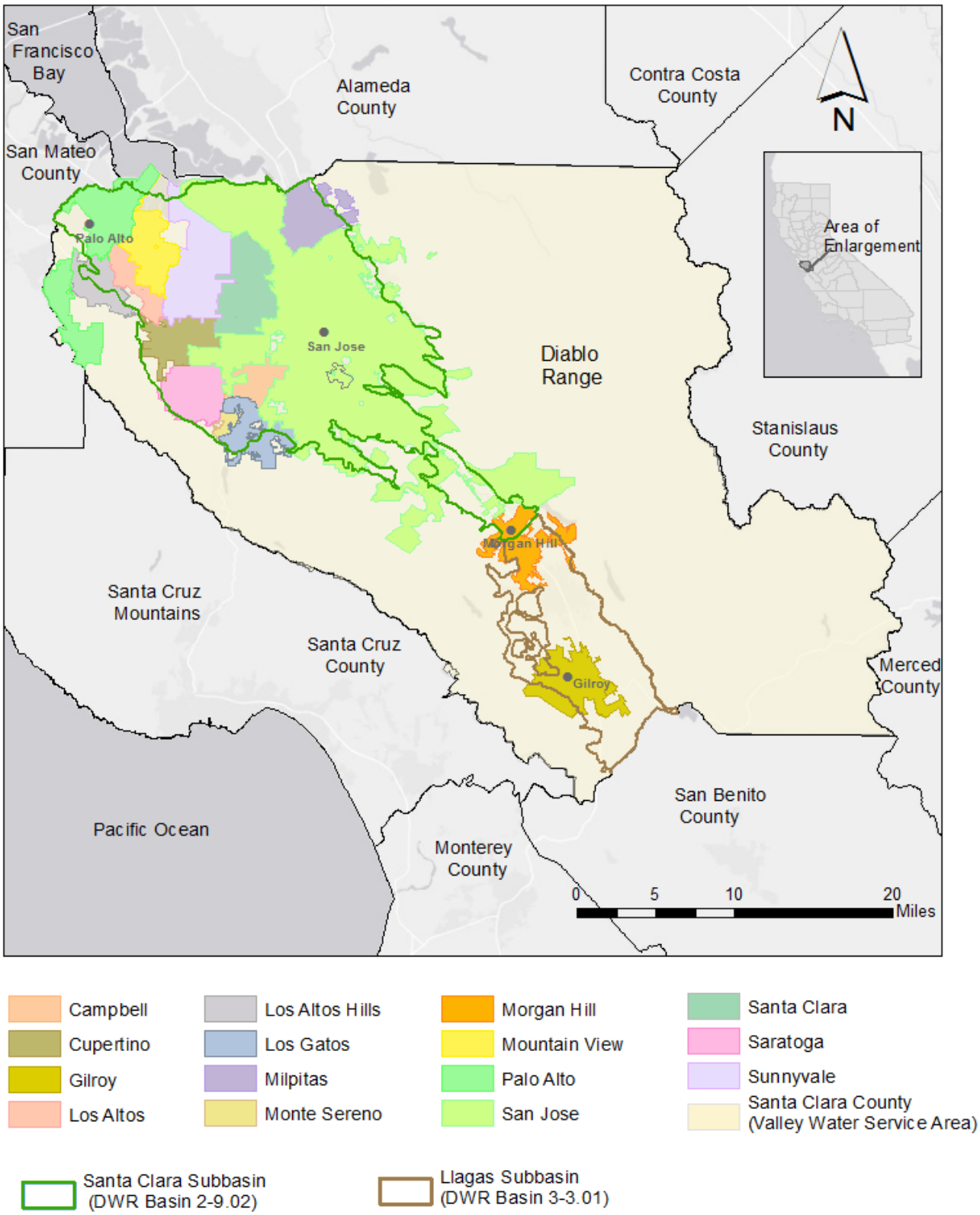
[5] Santa Clara Valley Water District Act, Water Code Appendix, Chapter 60.
[6] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater

Figure 1. Santa Clara and Llagas Subbasin Location Map



CHAPTER 2 – GROUNDWATER ELEVATION DATA

Valley Water tracks groundwater elevations, groundwater quality, and land subsidence through countywide groundwater monitoring programs. In WY 2020, Valley Water collected monthly groundwater elevation readings at 170 wells in the Santa Clara Subbasin and 58 wells in the Llagas Subbasin. Furthermore, local water retailers shared groundwater elevation data at 116 wells. While this report provides a summary of groundwater elevations based on 11 regional wells, all available countywide groundwater elevation data are accessible through the Valley Water website.[7] Valley Water also regularly uploads groundwater elevation data for Valley Water-owned wells to the California Statewide Groundwater Elevation Monitoring (CASGEM) program database[8].

Groundwater elevation contour maps for the Santa Clara and Llagas subbasins with related measurement locations are presented in Figures 2 and 3 for Spring 2020 and Fall 2020, respectively.[9] These contours represent the principal aquifer within each subbasin because those aquifers support the vast majority of pumping. Seasonal high groundwater conditions typically occur in March or April, with seasonal lows in September or October. The spring and fall maps (Figures 2 and 3) were created using the water level readings measured closest to March 31, 2020 and September 30, 2020, respectively.

This report also presents groundwater elevation data from 11 regional wells in the Santa Clara and Llagas subbasins (Figure 4); these wells are spatially distributed within the two subbasins and various cities in the county. Hydrographs for these regional wells show the static water level trend over the period of record, which varies by well (Figure 5).

Due to good water supply conditions, robust managed recharge, and continued water use reduction by the community, groundwater elevations recovered quickly from the 2012 to 2016 drought, generally returning to pre-drought conditions in WY 2017. In fact, water levels in many wells approached or exceeded historical high levels. Groundwater levels remained high in WY 2018, 2019, and 2020 (Figure 5) due to continued managed recharge and water use reduction. WY 2020 groundwater elevations in many regional wells were lower than WY 2019 due to dry conditions. However, the groundwater elevations remain far above the historical minima and levels during the last major droughts of 1987-1992 and 2012-2016, with strong artesian pressures observed in the northern Santa Clara Subbasin. Groundwater elevations in WY 2020 were also well above Valley Water thresholds established to minimize the risk of land subsidence in the Santa Clara Subbasin.[10]

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[7] https://gis.valleywater.org/GroundwaterElevations

[8] https://water.ca.gov/Programs/Groundwater-Management/Groundwater-Elevation-Monitoring--CASGEM

[9] Groundwater elevations in this report use the North American Vertical Datum of 1988 (NAVD 88).

[10] As described in the Plan, land subsidence was a significant issue historically in the central and northern Santa Clara Subbasin. See Valley Water's Annual Groundwater Report for Calendar Year 2019 for a detailed discussion of recent subsidence monitoring: https://www.valleywater.org/groundwater Note, the CY 2020 report will be available in summer 2021.

Figure 2. Spring 2020 Groundwater Elevation Contours

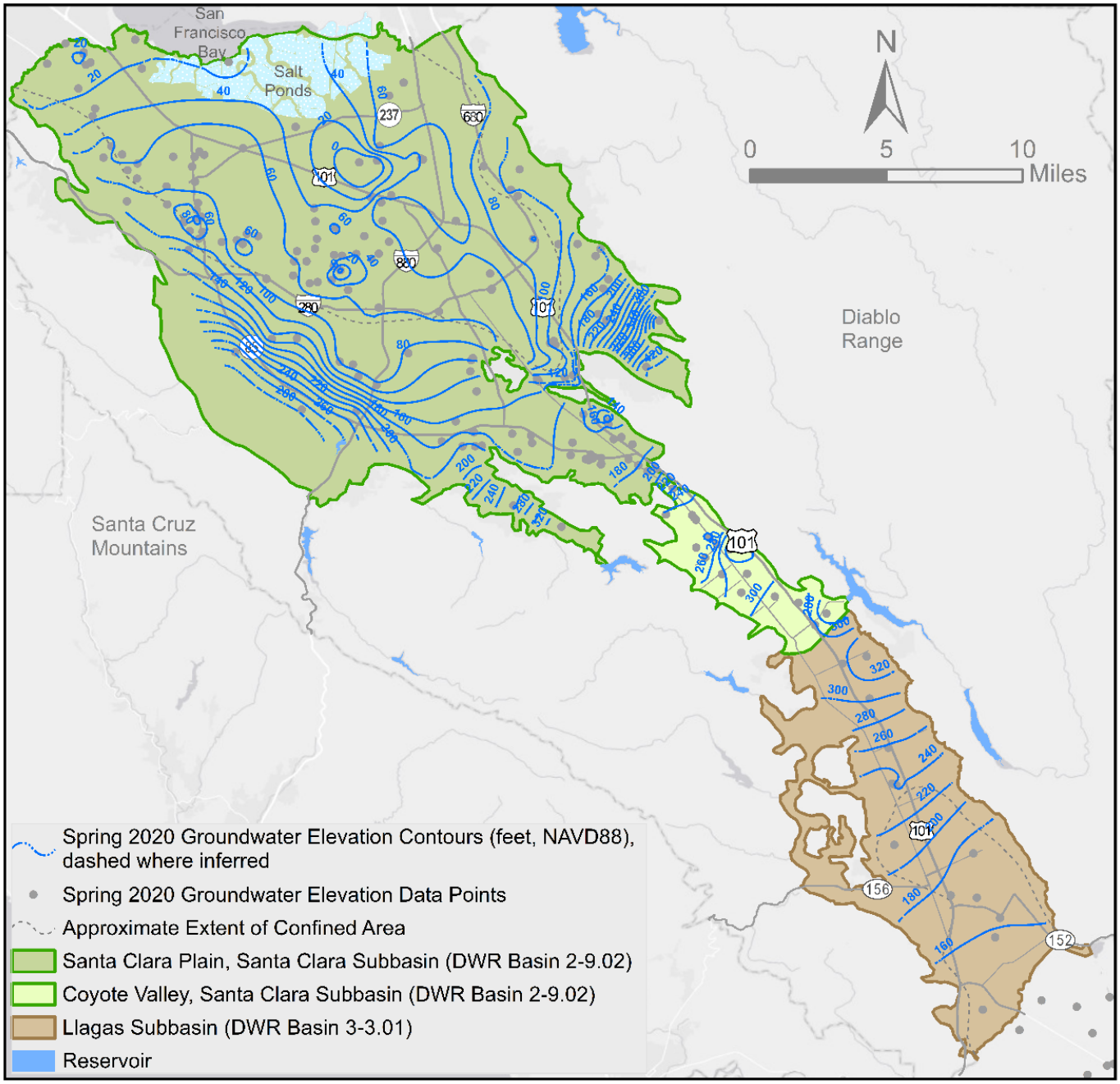


Figure 3. Fall 2020 Groundwater Elevation Contours

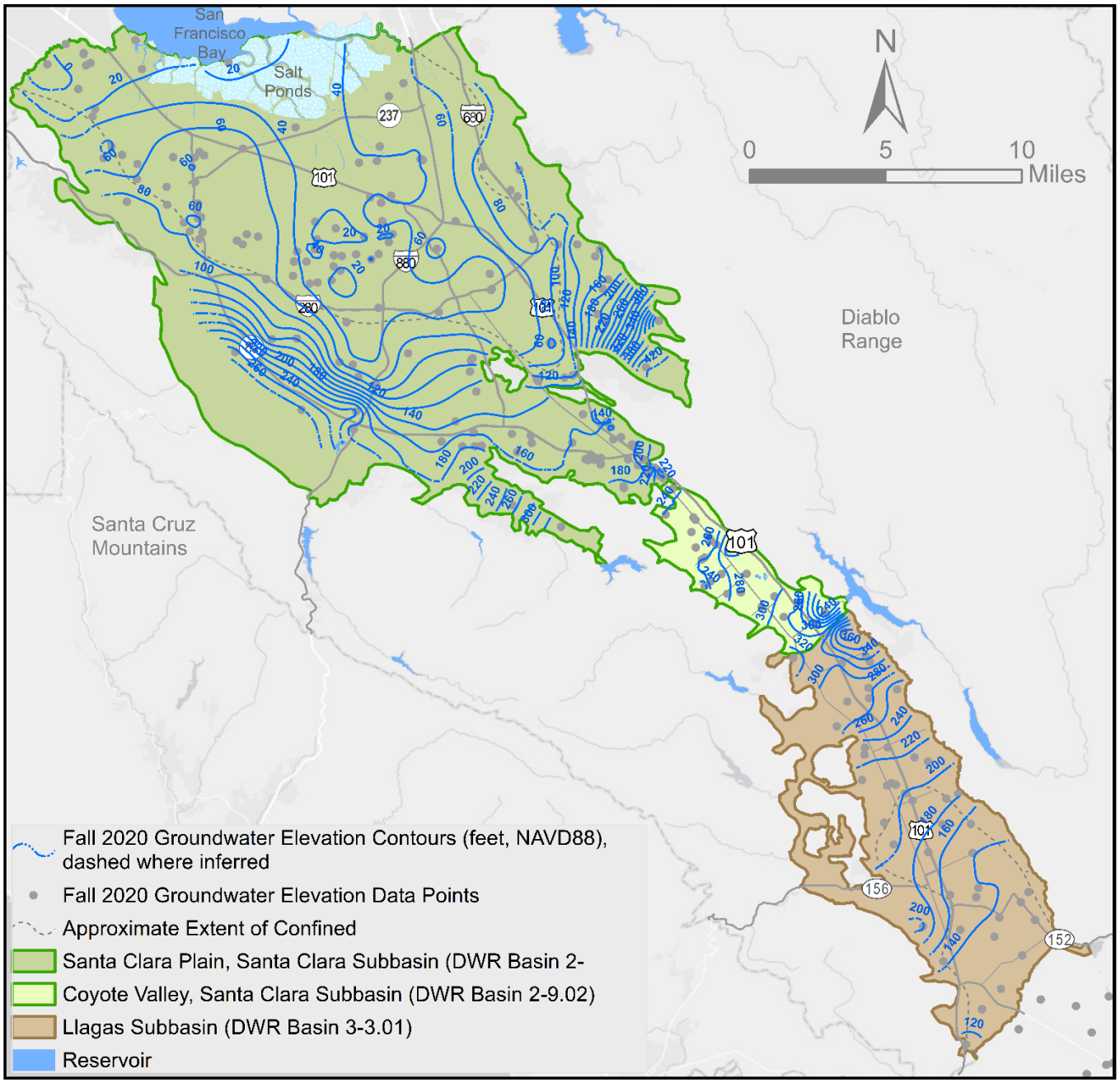


Figure 4. Regional Groundwater Elevation Monitoring Wells

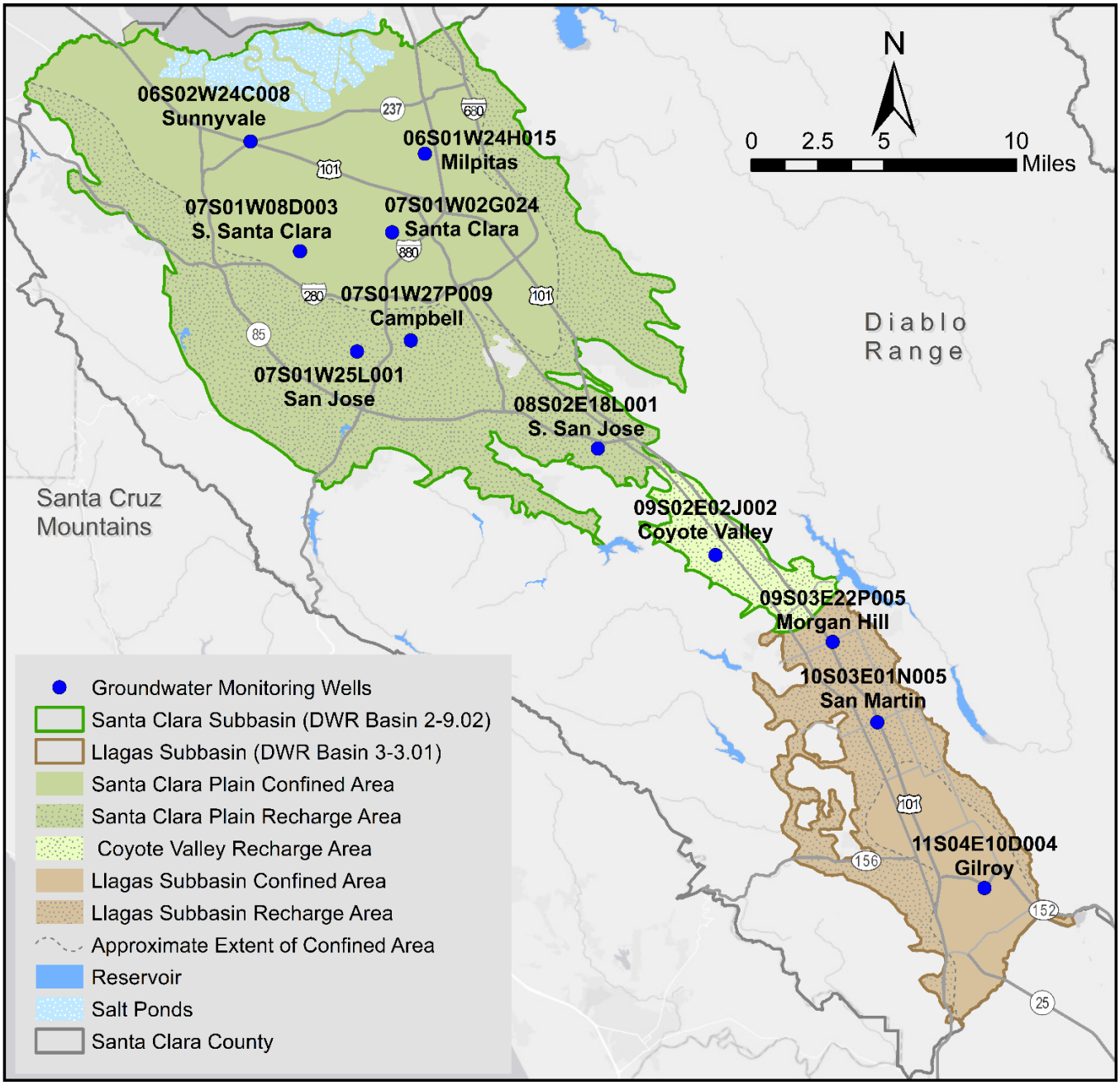
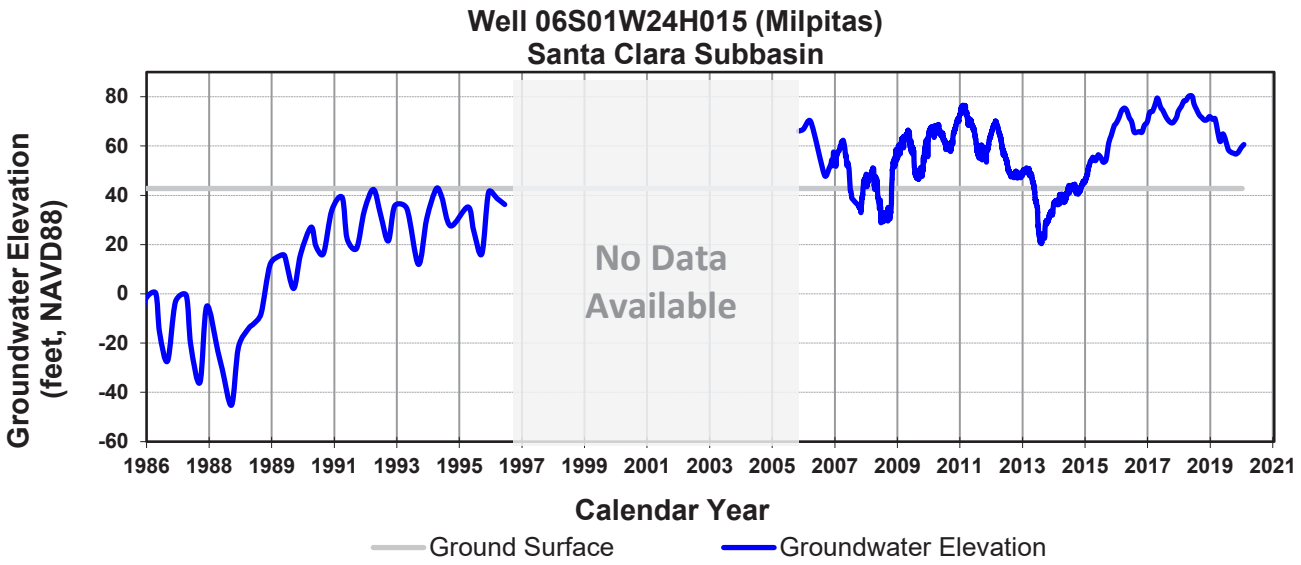
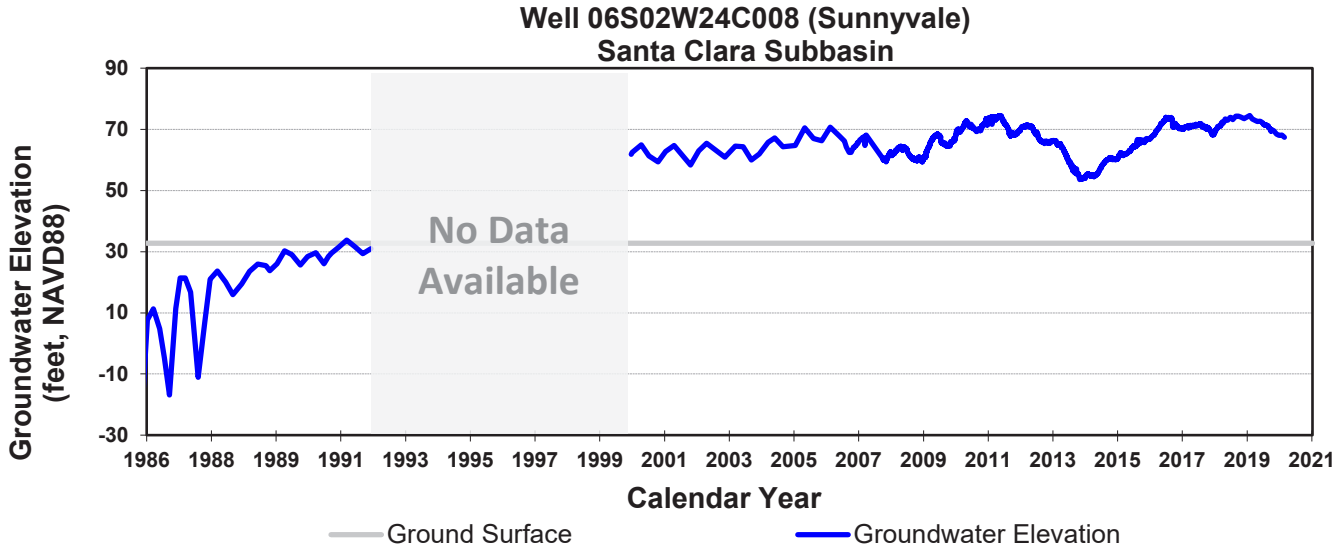


Figure 5. Hydrographs at Regional Groundwater Elevation Monitoring Wells

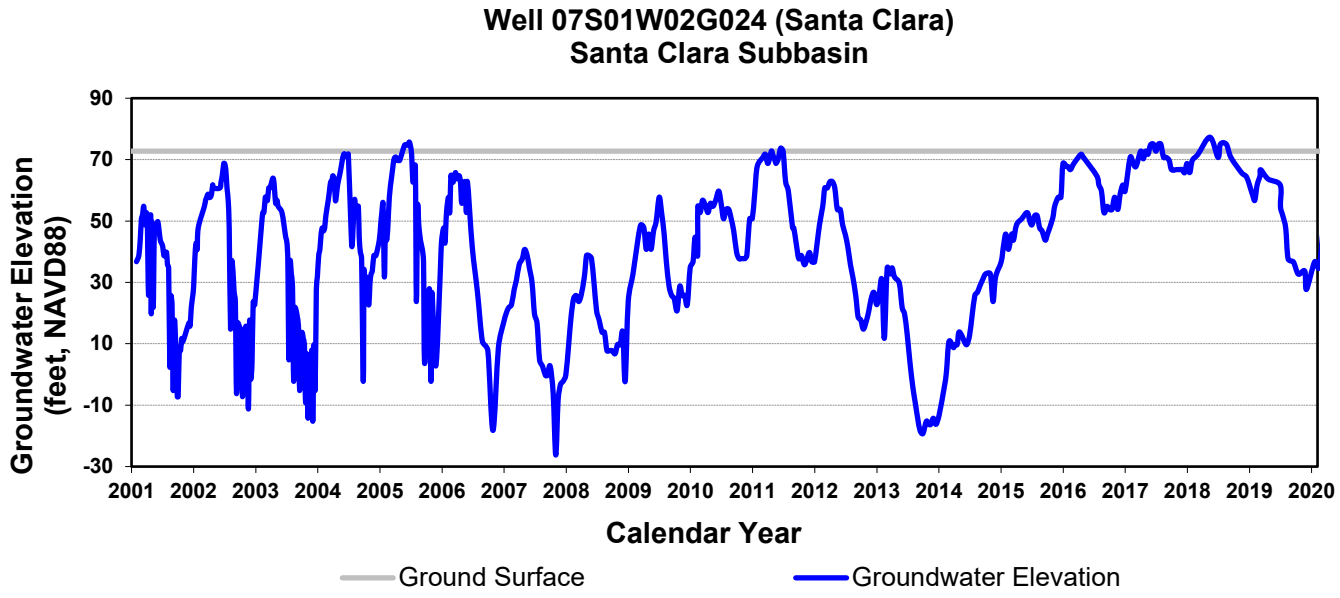


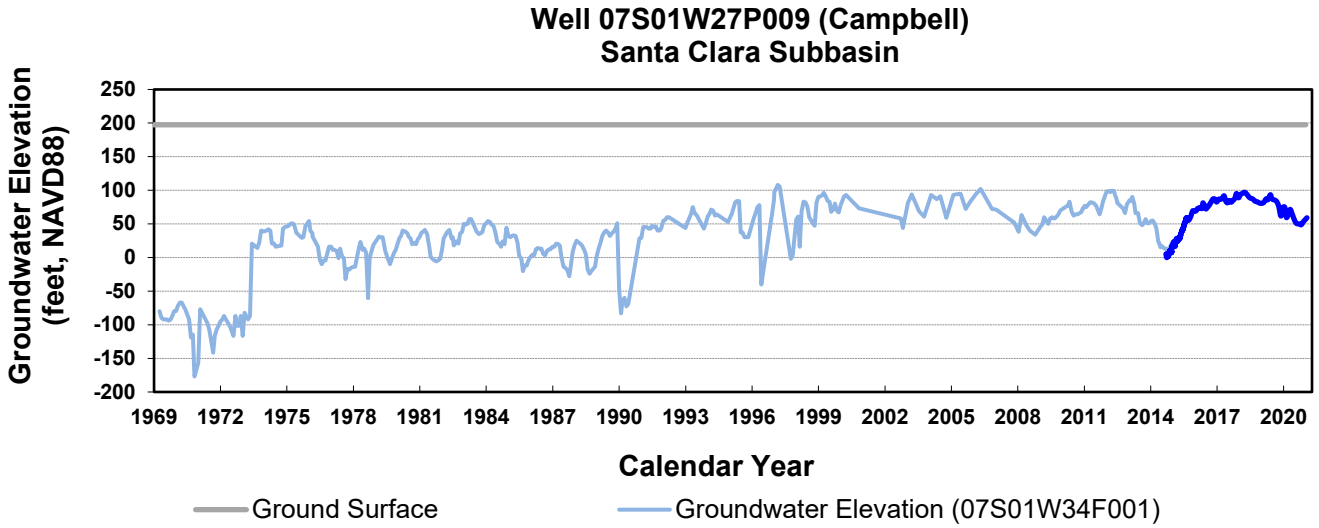
During period with no data available, well was observed to be artesian but there was no pressure gauge



During period with no data available, well was observed to be artesian but there was no pressure gauge

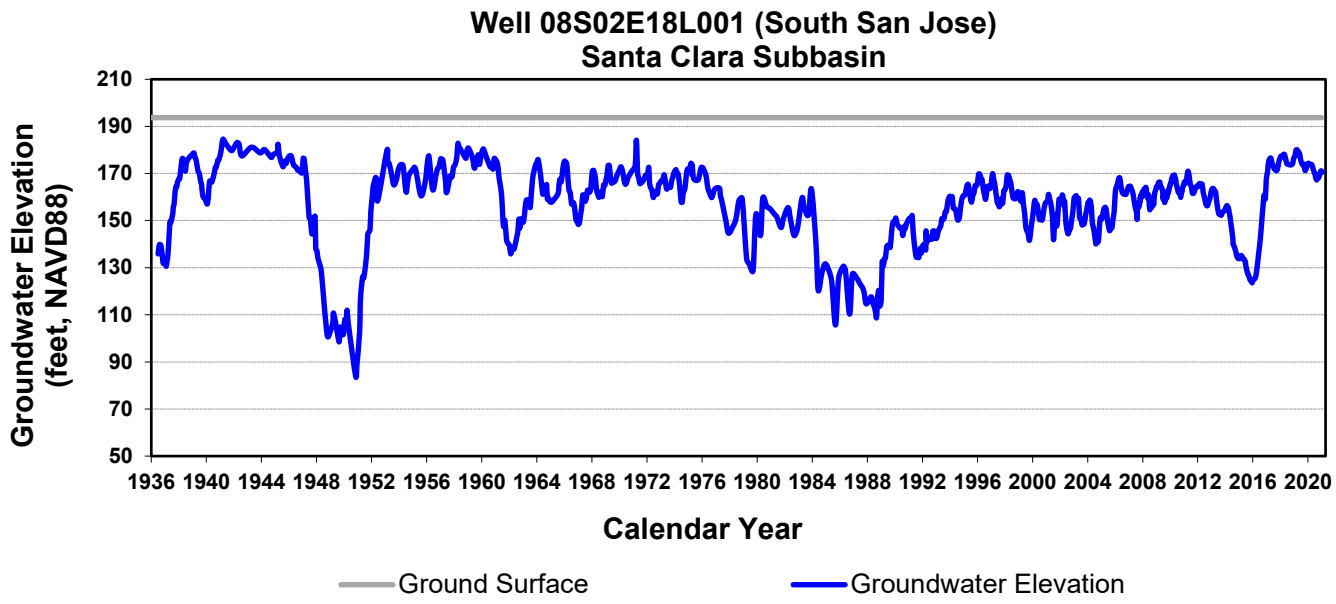
Figure 5. Hydrographs at Regional Groundwater Elevation Monitoring Wells (continued)





The Campbell well was replaced in August 2015 with a nearby well with similar water level history.

Figure 5. Hydrographs at Regional Groundwater Elevation Monitoring Wells (continued)



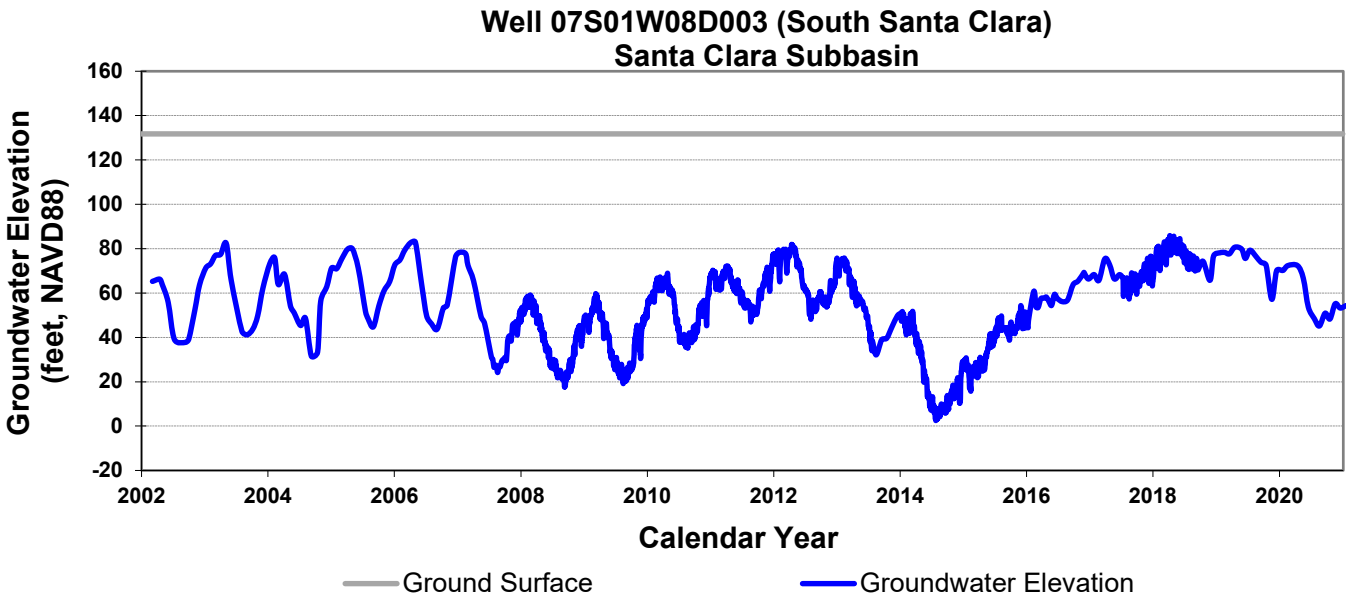
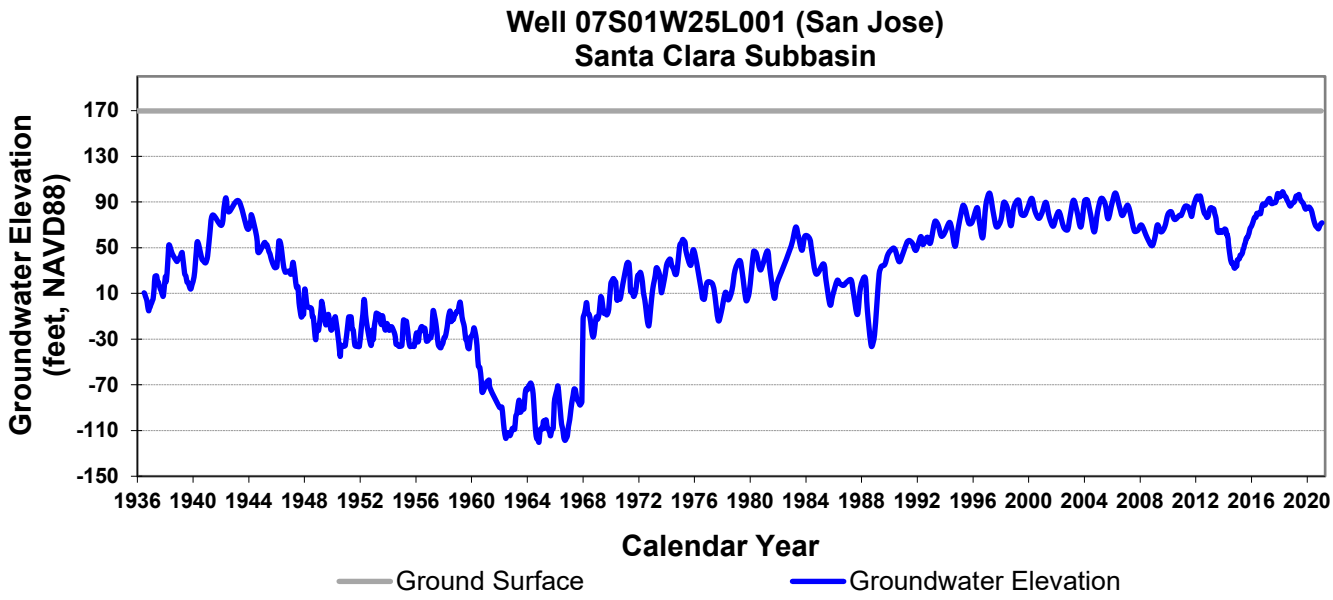


Figure 5. Hydrographs at Regional Groundwater Elevation Monitoring Wells (continued)



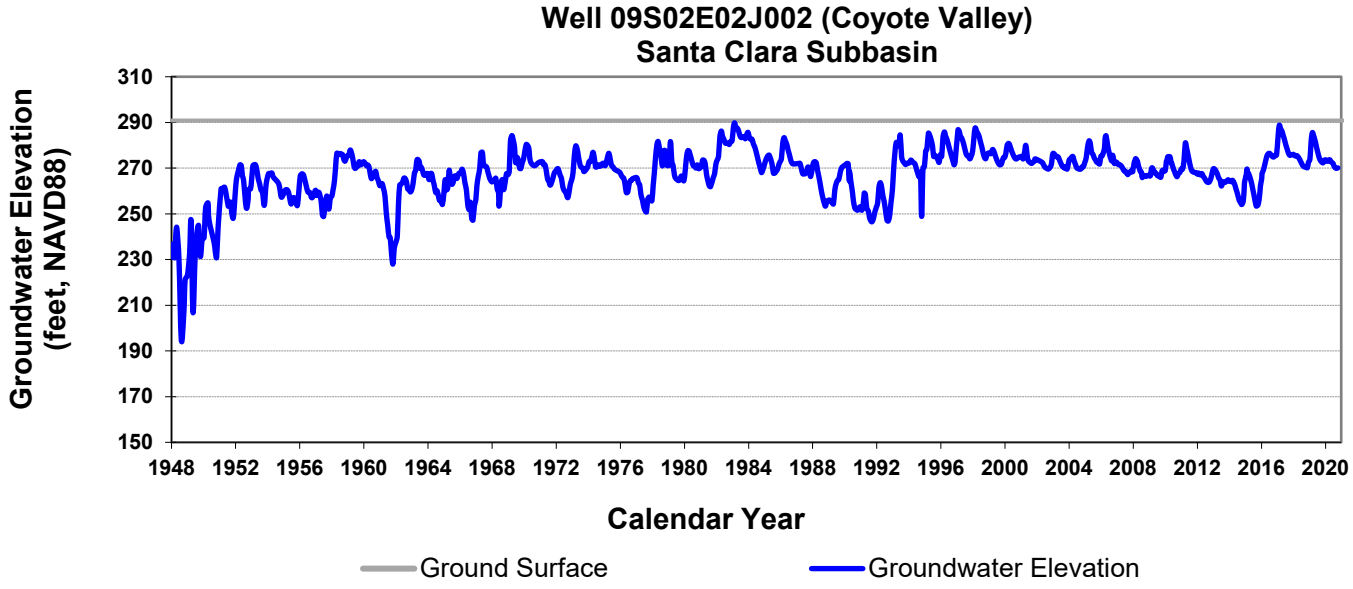
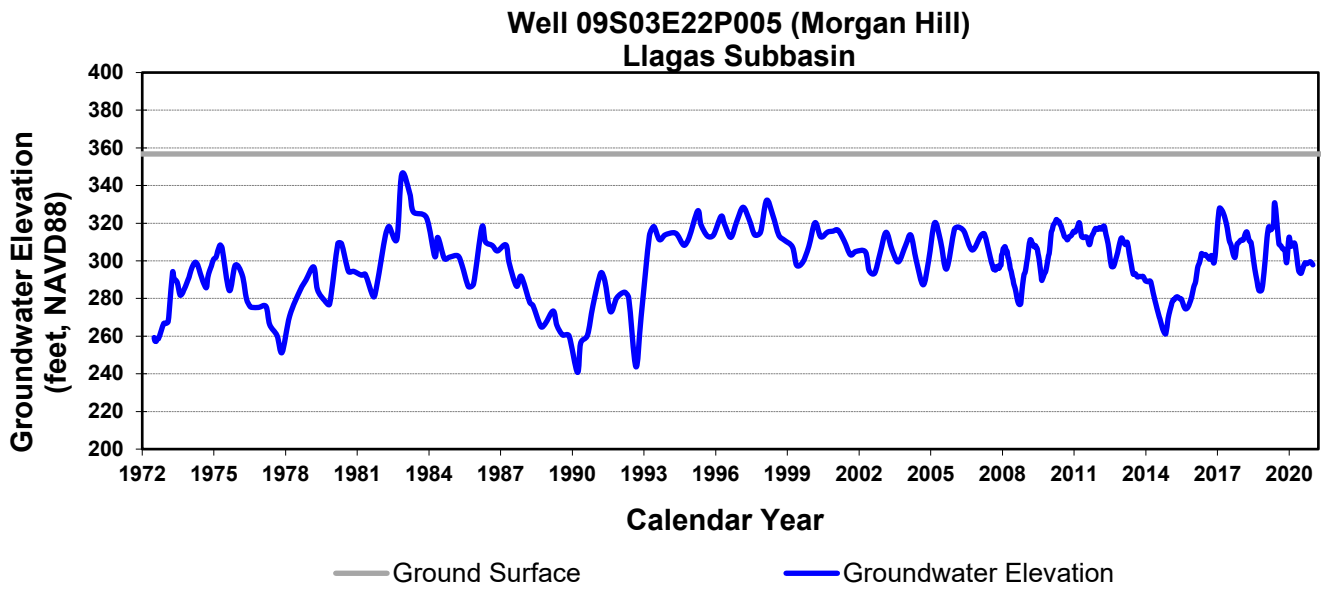
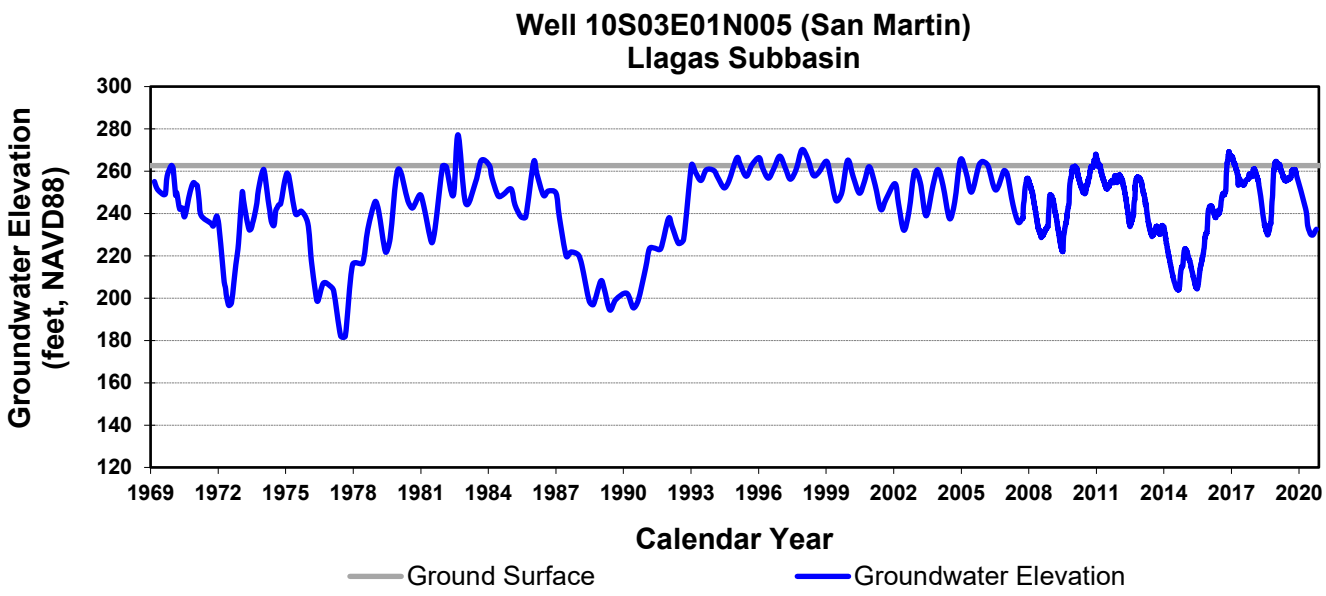


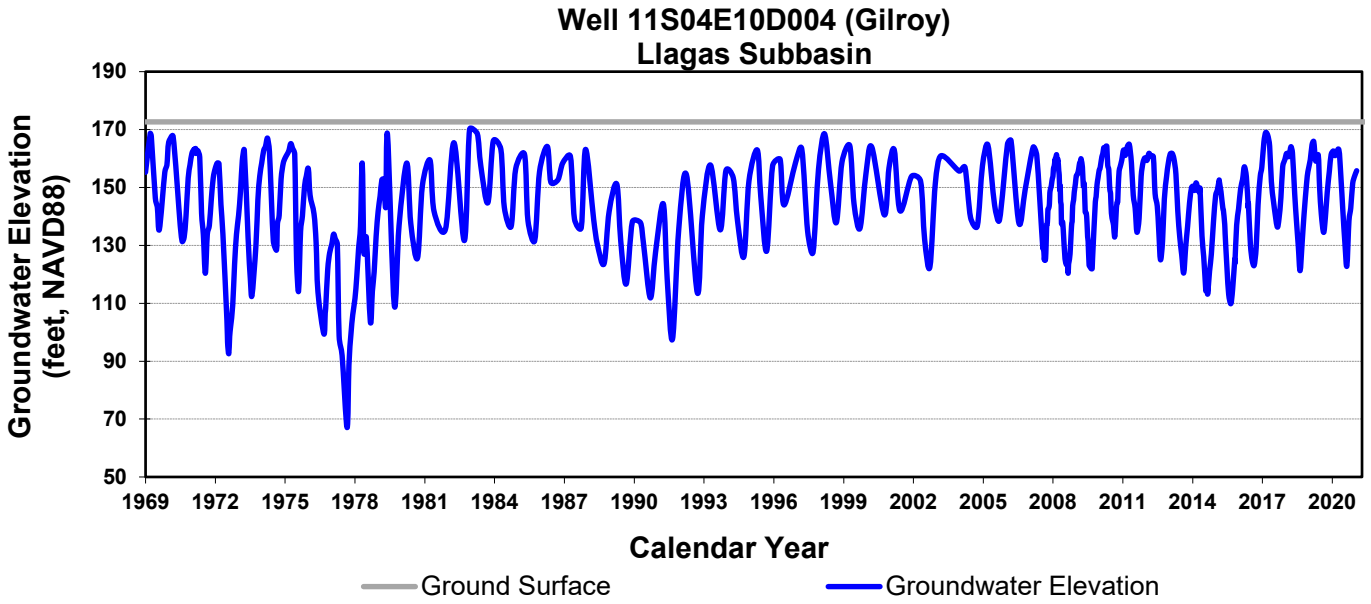
Figure 5. Hydrographs at Regional Groundwater Elevation Monitoring Wells (continued)





The San Martin index well was replaced in January 2021 with a nearby well with water levels similar to the prior well but with a more complete record and better access.

Figure 5. Hydrographs at Regional Groundwater Elevation Monitoring Wells (continued)



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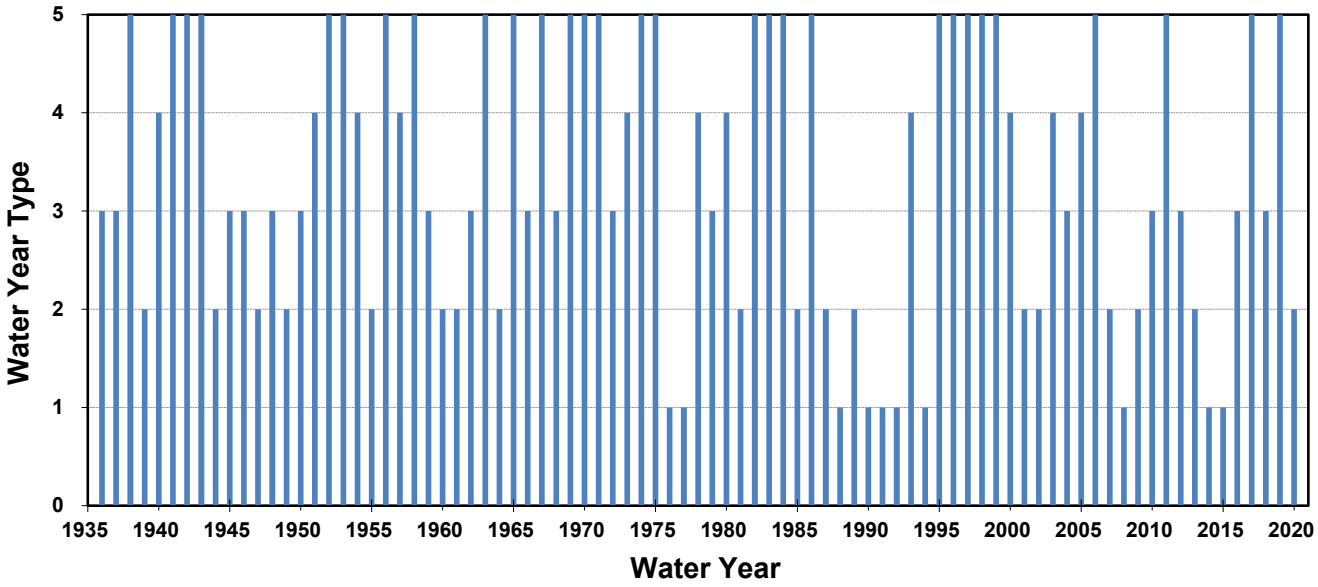
WY 2020 was a dry year based on the DWR Sacramento River Index (SRI) (Figure 6). Valley Water uses historical SRI water year types to model hydrologic conditions in Santa Clara County as it reflects conditions in the Sierra and the Sacramento-San Joaquin Delta that influence Valley Water's imported water deliveries. Rainfall stations within Santa Clara County confirm that the rainfall season from July 1, 2019 to June 30, 2020 was below the historical average. For instance, rainfall in downtown San Jose (Station 131) was approximately 5.7 inches or 46% of average.

Figure 6. Water Year Types from WY 1936 to 2020 – Sacramento River Index (SRI)



Water Year Types per DWR SRI: 1 (Critical); 2 (Dry); 3 (Below Normal); 4 (Above Normal); 5 (Wet)

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CHAPTER 3 – WATER SUPPLY AND USE

Valley Water manages a diverse water supply portfolio, with sources including groundwater, local surface water, imported water, and recycled water. About half of the county's water supply comes from local sources with the other half from imported sources. Imported water includes Valley Water's State Water Project (SWP) and Central Valley Project (CVP) contract supplies and supplies delivered by the San Francisco Public Utilities Commission (SFPUC) to northern Santa Clara County. Local sources include natural groundwater recharge and surface water supplies. A smaller but growing portion of the county's local water supply is recycled water.

Valley Water distributes local and imported surface water supplies to managed recharge facilities, three drinking water treatment plants, local creeks for environmental needs, or directly to water users. The conjunctive management of surface water and groundwater maximizes water supply reliability, allowing Valley Water to store surface water in local groundwater basins to help balance pumping and provide reserves for use during dry years or water shortages.

3.1 Groundwater Extraction

Total groundwater pumping in WY 2020 was 131,800 AF, providing 44% of the water used by county residents and businesses. Figure 7 shows the location and volume of groundwater pumping, and Table 1 summarizes pumping by subbasin, water use category, and measurement method and accuracy.

About 89,900 AF of groundwater was pumped in the Santa Clara Subbasin, with about 96% of that supporting municipal and industrial (M&I) uses (Table 1). Agricultural and domestic use totaling 3,700 AF was mostly in the more rural Coyote Valley in the southern Santa Clara Subbasin. Total pumping in the Llagas Subbasin was 41,900 AF. In this subbasin, agricultural use was more significant (22,300 AF), accounting for 53% of the total pumping. M&I groundwater use was 17,800 AF or 43% of subbasin pumping. While the quantity of groundwater used for domestic purposes was relatively small in the Llagas Subbasin (1,800 AF or 4%), over 2,600 individual domestic wells reported groundwater use in WY 2020.

Groundwater pumped from the subbasins is recorded in accordance with the Santa Clara Valley Water District Act. This act requires well owners and operators to register all wells within the county and to file monthly, semi-annual, or annual production statements for water-producing wells within Valley Water's groundwater benefit zones, with reporting frequency dependent on the amount of water produced. By Valley Water Board Resolution, meters are only installed at those sites determined to be economically feasible per approved criteria or as required to facilitate the complete and accurate collection of groundwater production revenue. In the northern Zone W-2, which essentially overlaps the northern Santa Clara Subbasin (Santa Clara Plain groundwater management area), meters are required for facilities producing more than 4 AF of agricultural water or more than 1 AF of non-agricultural water annually. Within Zone W-5 (Llagas Subbasin) and W-7 (Coyote Valley groundwater management area of the Santa Clara Subbasin), meters are required for facilities producing more than 20 AF of agricultural water or more than 2 AF of non-agricultural water.

Metered wells extracted the vast majority (120,900 AF or 92%) of the groundwater pumped in WY 2020. Where meters were not used, crop factors were used to determine agricultural water use, whereas domestic use was estimated from a table of average uses.

Figure 7. WY 2020 Groundwater Pumping in the Santa Clara and Llagas Subbasins

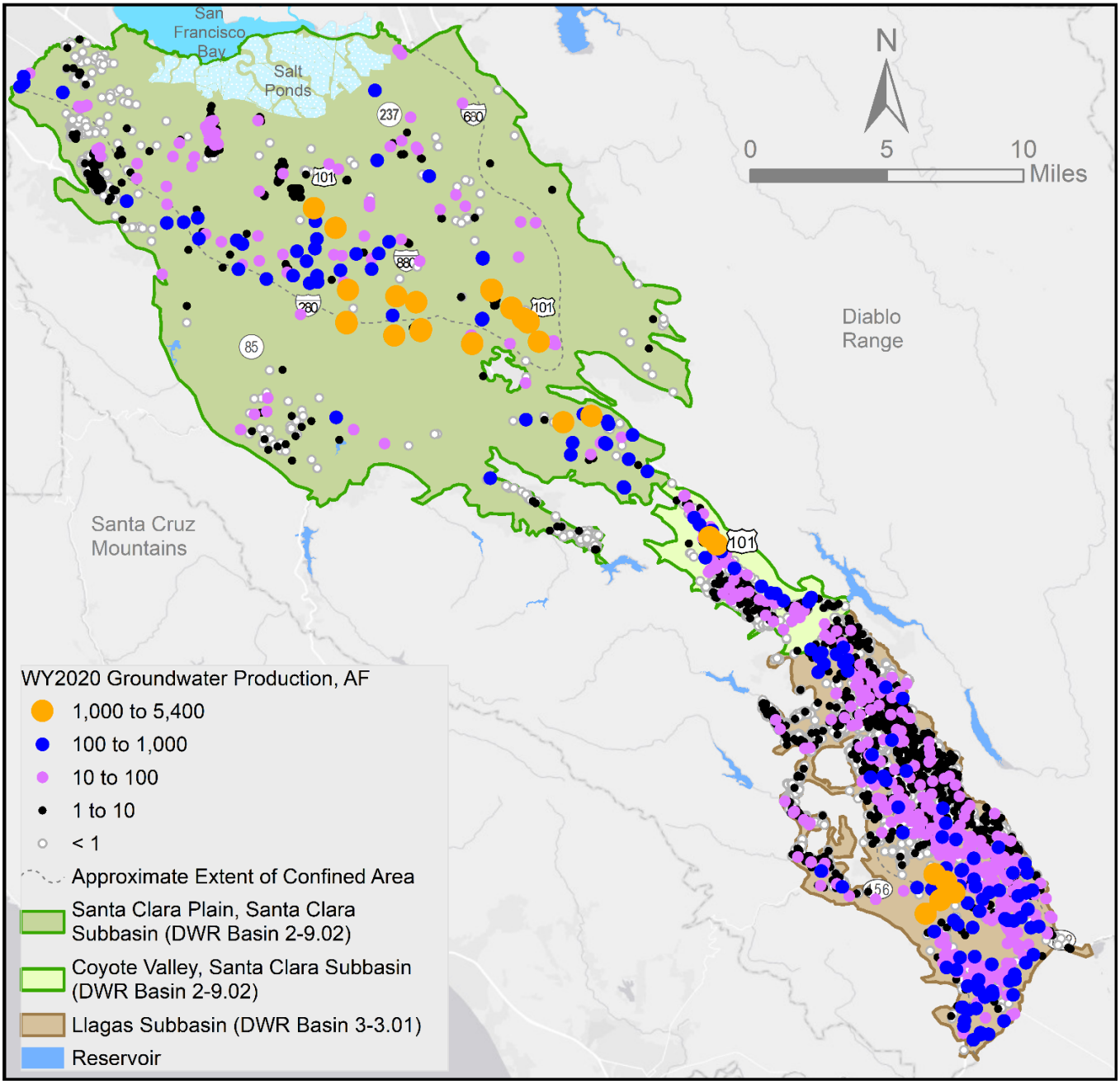

Table 1. WY 2020 Groundwater Pumping (AF) by Water Use

Water Use Sector	Measurement Method	Santa Clara Subbasin	Llagas Subbasin	Total Pumping	Accuracy
M&I	Metered	84,900	17,300	102,200	Within 2%
	Estimated	1,300	500	1,800	N/A
Domestic	Metered	100	100	200	Within 2%
	Estimated	300	1,700	2,000	N/A
Agricultural	Metered	2,600	15,900	18,500	Within 2%
	Estimated	700	6,400	7,100	N/A
Total		**89,900**	**41,900**	**131,800**	

Notes:

- As shown above, the majority of groundwater pumping is metered. Smaller pumpers are required to report production semi-annually or annually on a fiscal year (July 1 – June 30) basis. Non-metered pumpers report groundwater pumping based on crop factors (agricultural use) or table of average uses (domestic use). In this table, estimated pumping shown for the water year is based on fiscal year reporting and typical pumping patterns.
- All values are rounded to the nearest hundred.

3.2 Surface Water Supply Used

In WY 2020, Valley Water actively recharged about 80,600 AF of imported and local surface water in the Santa Clara and Llagas subbasins. Valley Water also provided about 104,700 AF of in-lieu recharge in the form of treated surface water deliveries to retailers (cities and water companies) (103,000 AF) and raw surface water deliveries to customers (1,700 AF) (Table 2). This is in addition to SFPUC deliveries to eight water retailers overlying the Santa Clara Subbasin and recycled water deliveries by Valley Water and four recycled water producers in the county, which totaled 65,800 AF countywide (Table 2). Valley Water's long-term water conservation programs also saved more than 75,000 AF, which further reduced the demand on groundwater.

Valley Water Managed Recharge

Valley Water replenishes the groundwater subbasins with imported water and watershed runoff captured in 10 local reservoirs. Valley Water's recharge facilities include more than 276 acres of recharge ponds and over 90 miles of creeks. Imported sources include the SWP and the federal CVP. The volumes of imported or local water used for managed recharge each year depend on many factors including hydrology, imported water allocations, treatment plants demand, and environmental needs. In general, a greater percentage of local water is used for recharge in wet years due to increased capture of storm runoff in local reservoirs. In WY 2020, Valley Water recharged about 59,400 AF of local and imported water in the Santa Clara Subbasin and about 21,200 AF in the Llagas Subbasin.

In-Lieu Use of Surface Water Supplies

Valley Water's treated and raw surface water deliveries, SFPUC supplies to local retailers, and recycled water programs play a critical role in maintaining groundwater elevations and storage by reducing demands on groundwater. Table 2 summarizes the supplies from these categories in areas that were historically primarily or solely served by groundwater.

3.3 Total Water Use

Total estimated water use in Santa Clara County in WY 2020 is summarized in Table 2, which includes water use categories, measurement methods and accuracy, water sources, and use sectors. While the county boundary extends beyond the subbasins, the vast majority of the population and water use coincides with the subbasins.

Table 2. Santa Clara County Total Water Use in AF for WY 2020

Water Use[1]	Santa Clara Subbasin	Llagas Subbasin	County-wide	Measurement Method	Accuracy	Source	Sector
Groundwater Pumped	89,900	41,900	131,800	Metered (92%) and estimated[2]	Within 2% (metered)	Managed recharge of local runoff and imported (SWP/CVP) water, natural recharge	M&I, domestic and agricultural[3]
Valley Water Treated Water Deliveries	103,000	0	103,000	Metered	Within 2%	Local runoff and imported (SWP/CVP) water	M&I
Valley Water Raw Surface Water Deliveries	700	1,000	1,700	Metered (95%) and estimated[2]	Within 2% (metered)	Local runoff and imported (SWP/CVP) water	M&I, domestic and agricultural
SFPUC Supplies to Local Retailers[4]	49,000	0	49,000	Metered	Within 1.5%	Surface water reservoirs[5]	M&I
Recycled Water	14,600	2,200	16,800	Metered	Variable[6]	Treated wastewater	M&I and agricultural
Total[7]	**257,200**	**45,100**	**302,300**				

[1] All water use values are rounded to the nearest hundred.
[2] Production from some smaller wells and raw surface water users is estimated using a table of average uses or crop factors.
[3] Groundwater use by sector is shown in Table 1.
[4] San Francisco Public Utilities Commission (SFPUC) supplies water to eight (8) retailers in Santa Clara County and NASA-AMES (https://sfwater.org/index.aspx?page=355).
[5] SFPUC primary sources are surface water reservoirs with runoff mainly from the Hetch Hetchy watershed and also from the Alameda and Peninsula watersheds. More information is available at:https://sfwater.org/index.aspx?page=355.
[6] Recycled water meter accuracy varies as each of the four producers within the county uses different methods to measure production and delivery of recycled water.
[7] Local water rights used by the San Jose Water Company (SJWC) and Stanford within the Santa Clara Subbasin are not reflected in the total because their local water rights have historically amounted to <3% of the total for the Santa Clara Subbasin.

3.4 Change in Groundwater Storage

Due to near record high groundwater levels, low pumping, and nuisance conditions in parts of the Santa Clara Subbasin during WY 2019, Valley Water decreased the managed recharge program. Due to decreased recharge

(caused by dry conditions and reduced managed recharge) and increased groundwater use in WY 2020, Valley Water estimates a net decrease in countywide groundwater storage of 28,100 AF in WY 2020 compared to WY 2019. Storage decreased by 25,800 AF in the Santa Clara Subbasin and by 2,300 AF in the Llagas Subbasin. Groundwater storage is the primary trigger for action under Valley Water's Water Shortage Contingency Plan, and storage remained well in the "Normal" stage (e.g., no shortage response required) in WY 2020.

Figure 8 depicts the change in groundwater elevation from October 2019 to September 2020 at more than 200 principal aquifer water level wells in the Santa Clara Subbasin and more than 45 wells in the Llagas Subbasin, respectively. The corresponding change in storage of 28,100 AF for the Santa Clara and Llagas subbasins, as estimated from Valley Water's calibrated groundwater flow models, is also shown in Figure 8.

Figures 9 and 10 present the water year type, groundwater use, annual change in groundwater storage, and cumulative change in groundwater storage for the Santa Clara and Llagas subbasins, respectively, from WY 1991 through WY 2020. These figures show that over this period, the annual change within each basin has most frequently been an increase in groundwater storage. The most notable exceptions, also evident in hydrographs, occur during droughts, as expected. However, Valley Water programs to recharge and manage groundwater support fairly rapid recovery of water levels and storage, helping ensure long-term sustainability. As mentioned previously, groundwater levels and storage in the Santa Clara and Llagas subbasins quickly recovered from the 2012-2016 drought, with groundwater elevations far above historical minima and drought levels, and strong artesian pressures observed in the northern Santa Clara Subbasin. While dry conditions are resulting in decreased water levels and storage, Valley Water has demonstrated proactive shortage response and ability to ensure groundwater recovery.

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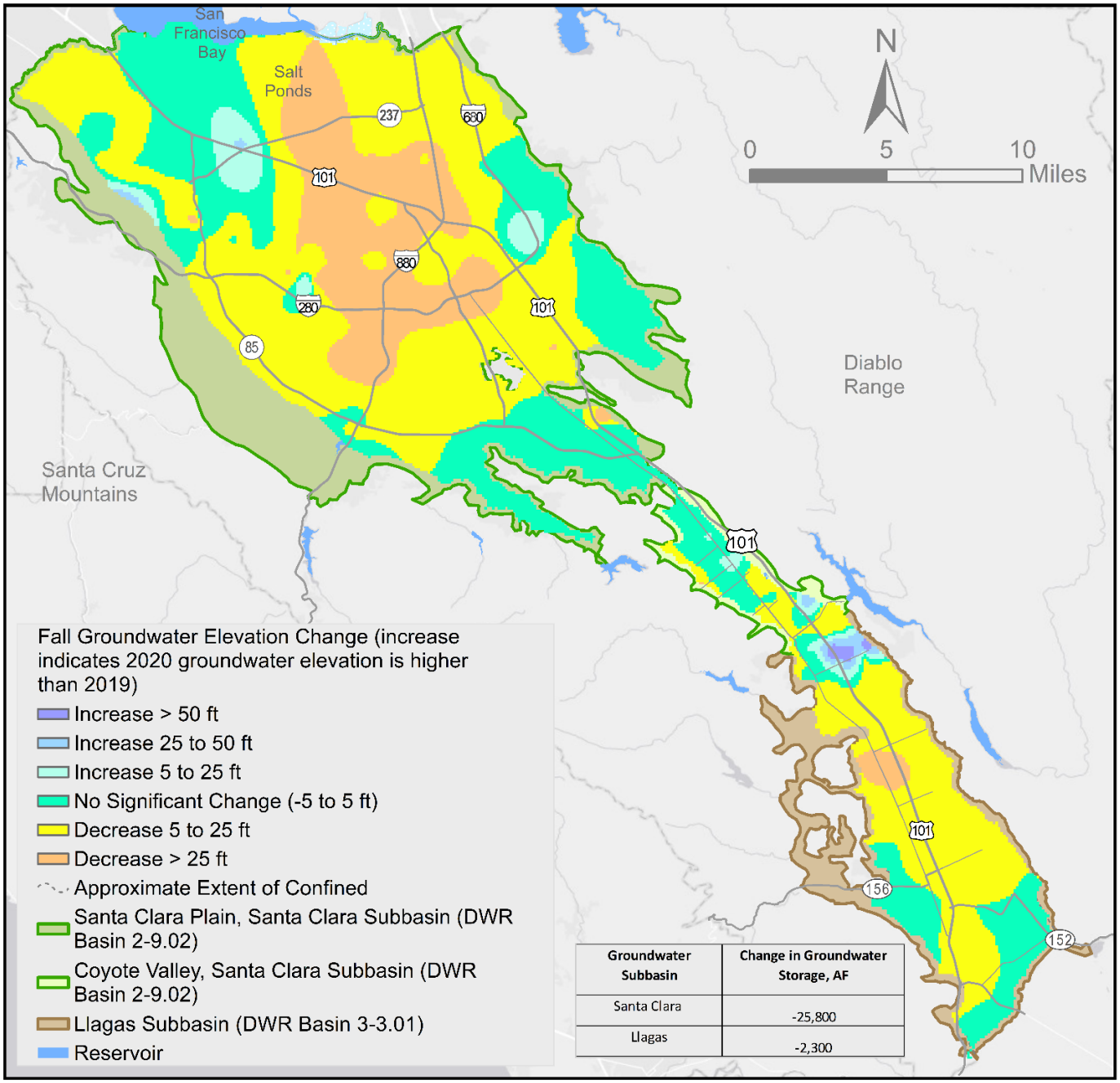
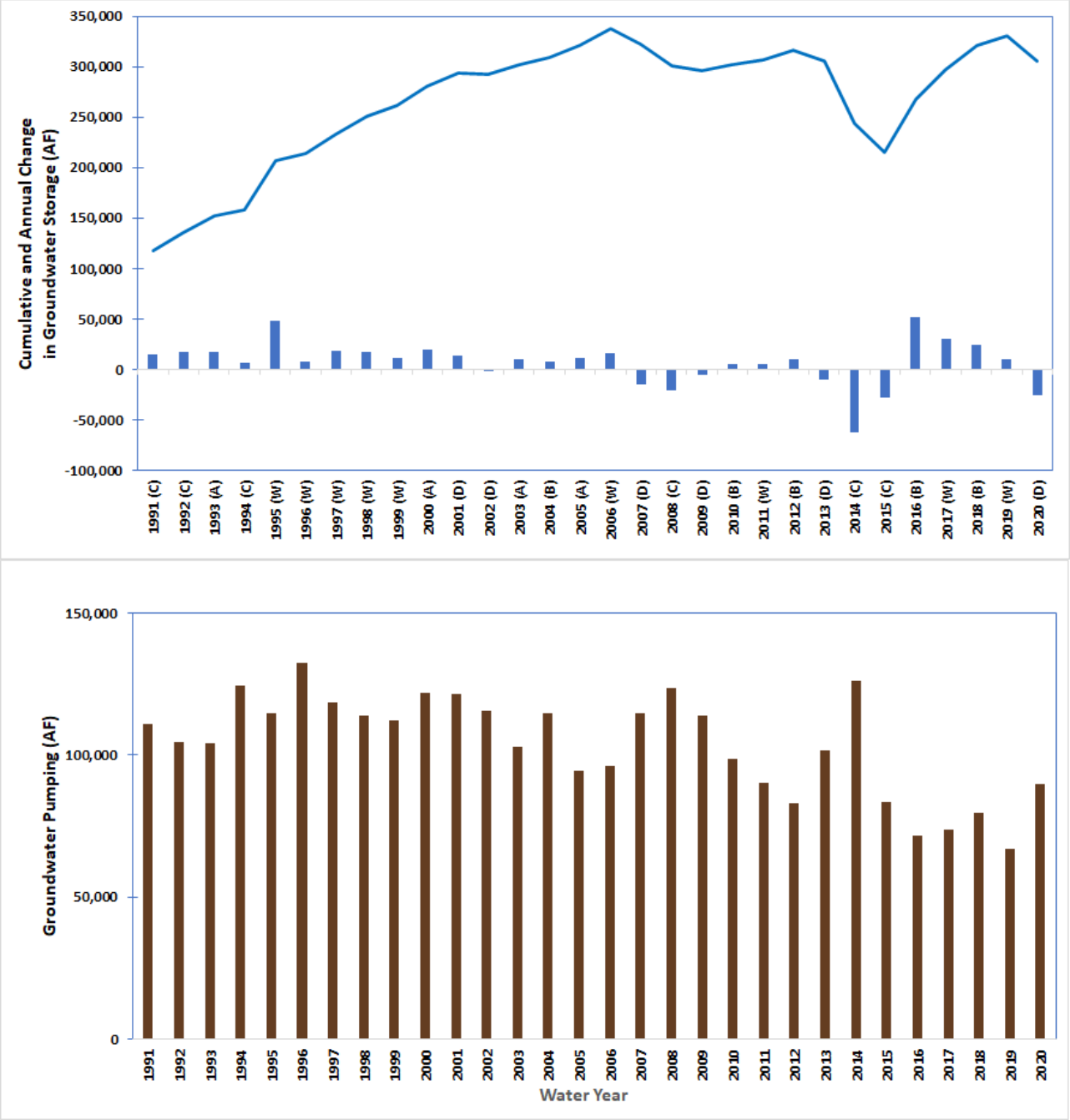
Figure 8. Change in Groundwater Elevation and Storage from October 2019 to September 2020



Groundwater Subbasin	Change in Groundwater Storage, AF
Santa Clara	-25,800
Llagas	-2,300

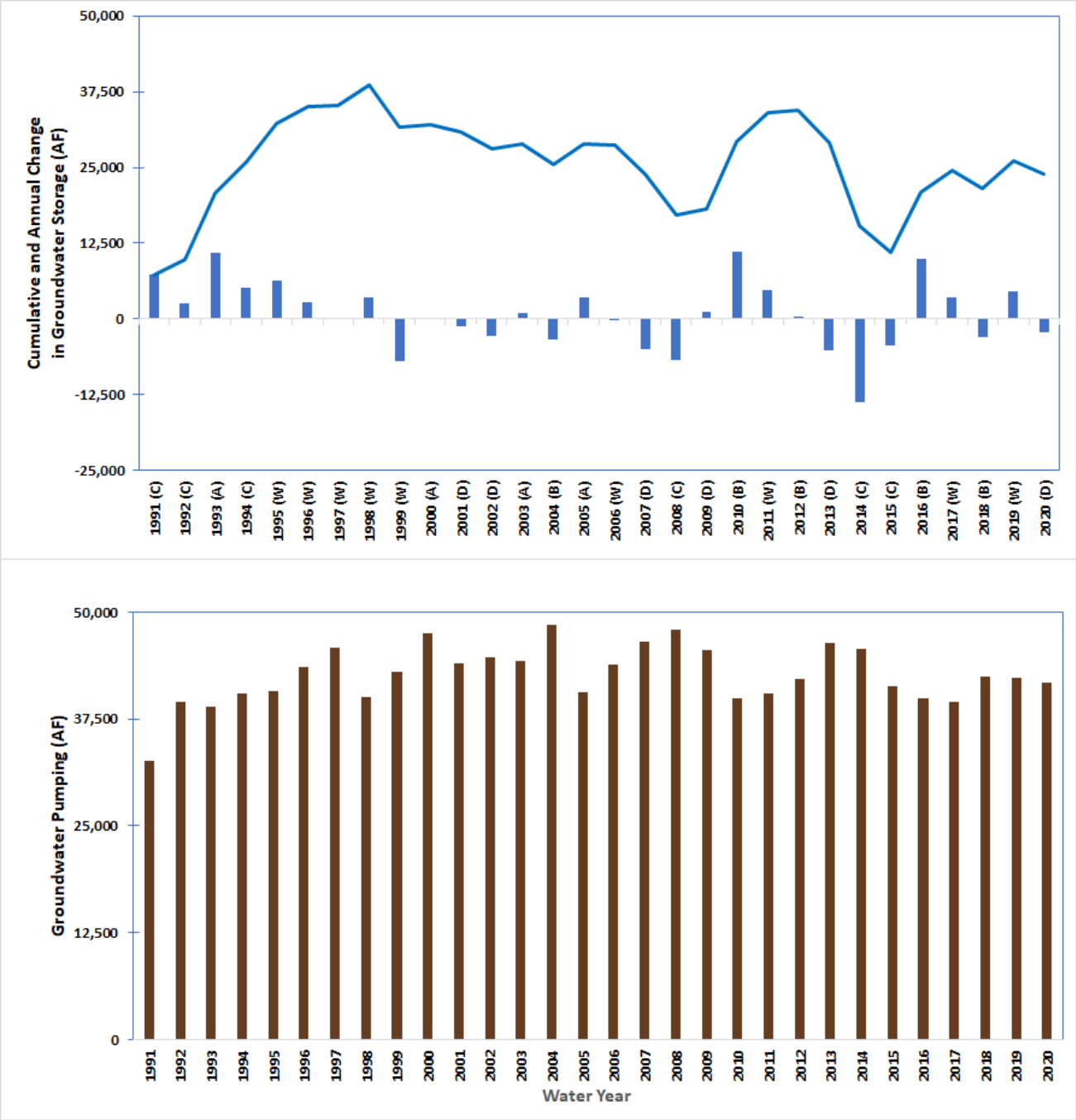
Figure 9. Groundwater Use and Change in Storage in the Santa Clara Subbasin



Notes:

- DWR SRI water year types are: Critical (C), Dry (D), Below Normal (B), Above Normal (A), and Wet (W).
- The storage graph begins in 1991 because Valley Water estimates Santa Clara Subbasin storage using two numerical models. The Santa Clara Plain model for the northern Santa Clara Valley begins in 1970 while the Coyote Valley model for the southern part of the subbasin begins in 1991 as Valley Water did not begin managing that area until the late 1980s.
- Most groundwater pumping is reported monthly and is reported here by water year. However, pumpers that report semi-annually or annually provide data based on the fiscal year (July 1 to June 30). For these reporters, groundwater pumping shown in this figure represents the fiscal year, which is presumed to be similar to the water year.

Figure 10. Groundwater Use and Change in Storage in the Llagas Subbasin



Notes:

- DWR SRI water year types are: Critical (C), Dry (D), Below Normal (B), Above Normal (A), and Wet (W).
- The storage graph begins in 1991 because Valley Water estimates Llagas Subbasin storage using a numerical model that begins in 1991 as Valley Water did not begin managing that area until the late 1980s.
- Most groundwater pumping is reported monthly and is reported here by water year. However, pumpers that report semi-annually or annually provide data based on the fiscal year (July 1 to June 30). For these reporters, groundwater pumping shown in this figure represents the fiscal year, which is presumed to be similar to the water year

CHAPTER 4 – PLAN IMPLEMENTATION

Valley Water continues to implement the comprehensive conjunctive management, groundwater monitoring, and groundwater protection programs described in the Plan. As a result, groundwater levels and storage in the Santa Clara and Llagas subbasins remain healthy and sustainable.

The Plan presents six major recommendations to maintain the long-term viability of groundwater resources. A summary of the status of each recommendation is below.

1. **Maintain existing conjunctive water management programs and evaluate opportunities for enhancement or increased efficiency.**

   This Plan recommendation has several sub-recommendations, including items related to infrastructure reliability, high-priority capital project implementation, and securing imported water sources, among others. Valley Water continues to focus on extensive groundwater recharge through direct replenishment and in-lieu recharge. Updates relative to this Plan recommendation are presented below.

   Capital Projects Supporting Conjunctive Management
   Valley Water continues to implement a comprehensive Capital Improvement Program (CIP). Valley Water's Fiscal Year Draft 2022-26 Five-Year CIP was approved for release on February 23, 2021.[11] With a significant portion of Valley Water's water supply infrastructure approaching fifty to sixty years of age, maintaining and upgrading the existing infrastructure to ensure each facility functions as intended for its useful life became the focus of the Water Supply CIP in recent years. Other CIP projects focus on expanding in-lieu and direct recharge through recycled and purified water projects. Major water supply capital improvements identified in the CIP include, but are not limited to:

   Storage:
   - Almaden Dam Improvements
   - Anderson Dam Seismic Retrofit
   - Calero Dam Seismic Retrofit
   - Guadalupe Dam Seismic Retrofit
   - Pacheco Reservoir Expansion
   - Dam Seismic Stability Evaluation

   Transmission:
   - 10-Year Pipeline Rehabilitation
   - Fisheries and Aquatic Habitat Collaborative Effort (FAHCE) Implementation
   - Vasona Pumping Plant Upgrade

[11] The draft 2022-26 CIP is available at:https://www.valleywater.org/how-we-operate/five-year-capital-improvement-program

- Almaden Valley Pipeline Replacement
- Distribution System Implementation Project

Treatment:
- Penitencia Water Treatment Plant Residuals Management
- Rinconada Water Treatment Plant Reliability Improvement and Residuals Remediation
- Rinconada Water Treatment Plant Treated Water Valves Upgrade
- Santa Teresa Water Treatment Plant Filter Media Replacement
- Water Treatment Plant Electrical Improvement

Recycled Water:
- Expedited Purified Water Program
- South County Recycled Water Pipeline
- Land Rights – South County Recycled Water Pipeline

Detailed information on each of these water supply capital projects, including related description, costs, and schedule, is available in the CIP.

2. **Continue to aggressively protect groundwater quality through Valley Water programs and collaboration with land use agencies, regulatory agencies, and basin stakeholders.**

Sub-recommendations from the Plan include continued groundwater quality monitoring, action when potentially adverse trends are identified, and continued/enhanced collaboration with local partners and stakeholders.

Groundwater quality is typically very good in the county, with no treatment beyond disinfection required at major retailer wells. However, nitrate remains an ongoing groundwater protection challenge, particularly in the more rural Coyote Valley and Llagas Subbasin. Valley Water continues to conduct extensive groundwater quality monitoring, evaluate long-term trends, and compare current conditions against regulatory standards and projected concentrations (such as from Salt and Nutrient Management Plans). Detailed information and analysis of all monitoring data is presented in Valley Water's Annual Groundwater Report, which is calendar-year based and published each summer.[12]

Long-term trends are favorable for nitrate, with about 90% of wells tested showing stable or decreasing concentrations. However, since a significant number of domestic wells in the Llagas Subbasin still contain nitrate above the drinking water standard, more work remains to be done. Valley Water will continue to engage with regulatory and land use agencies to address existing nitrate contamination. For nitrate and other

[12] The comprehensive Annual Groundwater Report for each calendar year is available at www.valleywater.org/groundwater

water quality issues, Valley Water will work to build and enhance this collaboration to protect high-quality groundwater and expedite the restoration of impacted groundwater.

Valley Water has been active in evaluating the potential threat posed by per- and polyfluoroalkyl substances (PFAS), a large group of unregulated chemicals widely used in fire-fighting foam and in consumer products. These "Forever Chemicals" are very stable in the environment and the human body, and scientific studies are increasingly documenting adverse health impacts. Voluntary sampling by Valley Water in WY 2020 does not indicate widespread PFAS presence in groundwater, but ten water supplier wells have been removed from service out of an abundance of caution. The presence of PFAS in local groundwater is concerning, and Valley Water is coordinating closely with local water retailers and regulatory agencies on this emerging issue.

In 2019, Valley Water worked with land use agencies to finalize a Stormwater Resources Plan[13] that will increase infiltration while ensuring pollutants from urban runoff are not merely transmitted from surface water to groundwater. Similarly, Valley Water continues to engage with various entities to ensure that recycled water expansion or the use of purified water for recharge will be protective of groundwater quality.

Engaging with land use and regulatory agencies on proposed policy, legislation, and projects that may impact groundwater remains a key strategy for protecting groundwater. For example, Valley Water tracks the progress of major contaminant release sites, interacting with regulatory agencies to promote expedited and thorough cleanup. Valley Water also engages with land use agencies on relevant projects and policies such as development, stormwater infiltration devices, septic systems, and small water systems.

Public outreach continues to be an important component of Valley Water's groundwater protection efforts. In WY 2020, Valley Water celebrated Groundwater Awareness Week by highlighting groundwater on the Valley Water website and posting related social media messages. Valley Water also maintained its status as a Groundwater Guardian through a program sponsored by the non-profit Groundwater Foundation. This is an annually earned designation for communities and affiliates that take voluntary, proactive steps toward groundwater protection.

To provide information on well sampling by Valley Water and local water suppliers, Valley Water prepared the 2019 Groundwater Quality Summary.[14] This annual report is similar to water retailer consumer confidence reports and provides basic groundwater quality information to domestic well owners who do not typically receive water from a water retailer.

Other groundwater-related public outreach conducted by Valley Water in WY 2020 included:

- Interaction with many students through the Education Outreach program.

[13] Santa Clara Basin Stormwater Resource Plan, Final August 2019 is available at https://scvurppp.org/wpcontent/uploads/2019/08/SCB_SWRP_FINAL_8-20-19.pdf

[14] The 2019 Groundwater Quality Summary Report is available at https://www.valleywater.org/sites/default/files/2020-07/2019%20Annual%20Groundwater%20Quality%20Summary%20Report.pdf

- Direct communication with well owners on groundwater quality, well maintenance, and treatment systems under the Domestic Well Testing and Nitrate Treatment System Rebate programs.

3. Continue to incorporate groundwater sustainability planning in Valley Water planning efforts.

This Plan recommendation focuses on continued, thoughtful water supply planning and investments. In November 2019, Valley Water completed an update to the Water Supply Master Plan 2040[15], which explains Valley Water's strategy for providing a reliable and sustainable water supply into the future. The Water Supply Master Plan 2040 informs investment decisions and provides a framework for annually monitoring the water supply strategy to ensure it will meet the water needs of Santa Clara County. Staff held multiple workshops with water retailers and stakeholders and presented information to the Board and the Board's Water Conservation and Demand Management Committee on numerous occasions. These presentations have included information on the proposed level of service goal and potential water supply investment strategies.

The Valley Water investment strategy includes securing existing supplies, expanding water conservation and reuse, and optimizing the system. Projects approved by the Board for planning include advanced metering infrastructure, leak repair incentives, expansion of Valley Water's graywater program, a model water-efficient ordinance for new developments, stormwater capture (e.g., incentives for rain barrels, cisterns, and rain gardens, and improved stormwater capture on agricultural lands), potable reuse, the Delta Conveyance Project, expanding Pacheco Reservoir, and the Transfer-Bethany Pipeline. Details about each of these projects can be found in Appendix H of the Water Supply Master Plan 2040. Updates on project planning and Water Supply Master Plan 2040 implementation are completed annually through the Monitoring and Assessment Program (MAP). The MAP process allows the Board to approve changes to the Water Supply Master Plan 2040 investment approach in response to new project or water supply conditions (e.g., lower than expected water demands, changes to imported water reliability, etc.). The most recent MAP report was presented to the Board in October 2020 and the next MAP report is expected to be completed in August 2021.

Groundwater sustainability also remains an important factor during the planning and implementation of multi-benefit projects under Valley Water's One Water Plan[16]. The Sustainable Groundwater and Water Quality objectives of the One Water Plan align with the Plan outcome measures and the process to identify individual projects on the watershed scale (e.g., Coyote Watershed) accounts for groundwater conditions and sustainability.

To support managed response to climate change, Valley Water has developed a draft Climate Change Action Plan (CCAP) with input from both internal and external stakeholders. The CCAP will include comprehensive review of climate change as it relates to Valley Water core services and include goals, strategies, and possible actions to respond to climate change. The CCAP will identify potential future climate change vulnerabilities and

[15] Santa Clara Valley Water District, Water Supply Master Plan 2040 is available at https://www.valleywater.org/sites/default/files/Water%20Supply%20Master%20Plan%202040_11.01.2019_v2.pdf
[16] https://onewaterplan.wordpress.com/

risks to all core service areas, including water supply and groundwater management. The CCAP's goals and strategies will reduce risks to Valley Water core services and its mission. The strategies will be incorporated into existing Valley Water plans, budgets, and long-term financial forecasts as appropriate.

4. Maintain adequate monitoring programs and modeling tools.

This Plan recommendation focuses on improving monitoring networks by identifying and addressing gaps, redundancies, and access issues; identifying and implementing improvements to the numerical groundwater flow models; and improving Valley Water's understanding of surface water/groundwater interaction and groundwater dependent ecosystems (GDEs). In addition to the comprehensive, calendar-year based Annual Groundwater Report, Valley Water produces high-level monthly Water Tracker[17] and groundwater condition reports[18] that help keep stakeholders informed about current groundwater conditions including groundwater pumping, recharge, and water levels.

Valley Water continues to offer free basic well testing for domestic well owners to supplement regional groundwater quality monitoring, which emphasizes the use of consistent wells. Through this voluntary program, Valley Water obtains valuable data on nitrate and other contaminants while providing important water quality data to about 200 private well owners each year. This program was suspended in March 2020 due to the pandemic, but Valley Water is hoping to resume the program in 2021. Valley Water is also evaluating the recycled water and recharge water quality monitoring networks to ensure they meet monitoring objectives in terms of frequency, locations, and constituents analyzed.

Valley Water uses three calibrated groundwater flow models – one for each groundwater management area (Santa Clara Plain, Coyote Valley, and the Llagas Subbasin). These models are used to evaluate groundwater storage and levels to inform operational decisions and long-term planning efforts. Staff is assessing each model to identify improvements or enhancements that may be needed or desired to improve the use of these tools.

Regarding surface water/groundwater interaction, Valley Water staff has begun to evaluate existing available data for stream gauging and groundwater levels. Valley Water is also evaluating whether existing wells adjacent to creeks may be useful in collecting additional data to better understand the interaction. Staff has attended workshops organized by DWR and reviewed both relevant literature and how other GSAs are working to better understand groundwater-surface water interaction. Staff has also performed preliminary experiments to measure the flux between surface water and groundwater. Valley Water will continue to explore the complex and dynamic interaction between surface water and groundwater and will engage interested stakeholders. This issue will be further documented in the five-year Plan update, which is due by January 1, 2022.

[17] https://www.valleywater.org/your-water/water-supply-planning/monthly-water-tracker
[18] https://www.valleywater.org/your-water/groundwater/groundwater-monitoring

5. Continue and enhance groundwater management partnerships with water retailers and land use agencies.

This Plan recommendation focuses on continued collaboration and strong partnerships with water retailers and land use agencies. Valley Water continues to interact regularly with water retailers through quarterly Water Retailer meetings, including the Groundwater Subcommittee. In addition to these regular meetings, Valley Water and water retailers collaborate on various issues that arise regarding groundwater, treated water, wells, and water measurement.

Valley Water also continues to coordinate with local land use agencies on General Plans, water supply assessments, Urban Water Management Plans, stormwater management, and various individual land use projects. Land use decisions fall under the authority of the local cities and the County of Santa Clara. Valley Water reviews land use and development plans related to Valley Water facilities and watercourses under Valley Water jurisdiction and provides technical review for other land use proposals as requested by the local agency. When provided by land use agencies, water supply assessments for new developments are also reviewed and evaluated in the context of Valley Water's long-term water supply plans. For all reviews, Valley Water's groundwater-related comments focus on potential impacts to groundwater quality and sustainability.

6. Evaluate the potential new authorities provided by SGMA.

The Santa Clara Valley Water District Act provides broad authorities, but there are additional authorities under SGMA including the ability to regulate pumping or impose various types of fees. This Plan recommendation focused on the evaluation of these new SGMA authorities in cooperation with water retailers and other interested stakeholders to consider what conditions might necessitate their implementation to sustainably manage groundwater into the future.

As first described in the WY 2017 Annual SGMA Report submitted to DWR, Valley Water has explored new SGMA authorities with interested stakeholders through the Board's Water Conservation and Demand Management Committee (Committee). Nine publicly noticed Committee meetings between December 2016 and December 2017 provided a transparent forum for discussion with interested stakeholders on how and when these authorities might be used.

The potential regulation of pumping or well construction is a complex and controversial topic, which was discussed extensively through Committee meetings. Existing groundwater management programs and strong partnerships with large pumpers are expected to result in continued sustainable conditions and are the preferred way to address future challenges. However, pumping regulation may be needed in the future to address undesirable results. The primary SGMA-related work product from the Committee meetings was a process that describes the fundamental approach to respond to potential worsening basin conditions. This includes the steps that would be taken prior to implementing SGMA authorities to regulate groundwater pumping, with a focus on providing some certainty on the process, while avoiding prescriptive requirements that may not be effective in addressing a future issue. This process was memorialized via a resolution adopted by

Valley Water Board on February 27, 2018. This resolution was included as Attachment 2 in the WY 2018 Annual SGMA report to DWR.

Valley Water also explored the potential to implement a fixed charge as a component of groundwater production charges, which are currently volumetric charges. This could potentially reduce volatility in rates and revenues based on changes in water use. Valley Water engaged a consultant to develop a fixed charge proposal and assist with implementation. However, major water retailers expressed significant concerns, including redundancy with other charges or charge adjustment mechanisms, equity in applying the charge to all well users, and potential cost recovery impacts to retailers regulated by the California Public Utilities Commission. After discussing these concerns with the Committee and the full Board, Valley Water is unlikely to further pursue a fixed charge at this time.

NEXT STEPS

Valley Water will continue to submit annual reports required under SGMA to DWR by the April 1 deadline. In addition to this brief report, Valley Water will also continue to publish a comprehensive, calendar-year based Annual Groundwater Report each summer with more detailed information on pumping, recharge, water balance, groundwater levels and storage, land subsidence and groundwater quality. The most recent report, the Annual Groundwater Report for Calendar Year 2019, is posted on the Valley Water website, and will be replaced with the 2020 Report in the summer of 2021.[19]

Ensuring continued groundwater sustainability is central to the Valley Water mission to provide Silicon Valley a safe, clean water supply for a healthy life, environment, and economy. As such, Valley Water will continue to "aggressively protect groundwater from the threat of contamination and maintain and develop groundwater to optimize reliability and to minimize land subsidence and salt water intrusion," in accordance with Board policy.

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[19] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater

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